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March 19, 1996

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Michael Anastasio, Esq.
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United States Environmental
Protection Agency
77 W. Jackson Blvd., CS-3T
Chicago, IL 60604

Re: Granville Solvents Site (AT&T-GIS, et al. v. Union Tank Car Company, et al.

Dear Mike:

I have enclosed a copy of a report dated March 8, 1996 prepared by Civil & Environmental Consultants, Inc. on behalf of Armco, Inc. for the Granville Solvents Site. The report evaluates actions taken by the United States Environmental Protection Agency and Metcalf & Eddy, Inc. at the site.

Among other things, the report questions whether any or certain response actions should have been undertaken, and whether the actions undertaken conformed to acceptable practices. We are in the process of evaluating the report and I expect that the report may be used in summary judgment proceedings in the PRP Group's cost recovery litigation. We may desire to secure an affidavit from USEPA and I thought that you may be interested in the contents of the report.

Sincerely yours,

Ben L. Pfefferle, III

BLP:cjc

Enclosure

EXPERT REPORT
GRANVILLE SOLVENTS SITE

Prepared for:

KIRKPATRICK & LOCKHART LLP
HARRISBURG, PENNSYLVANIA

CEC Project 96163

March 8, 1996

Civil & Environmental Consultants, Inc.

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March 8, 1996

Craig Wilson, Esquire
Kirkpatrick & Lockhart LLP
Payne-Shoemaker Building
240 North Third Street
Harrisburg, Pennsylvania 17101-1507

Dear Craig:

Subject: Expert Report
Granville Solvents Site
CEC Project 96163

Attached is a copy of the expert report for the Granville Solvents Site.

Very truly yours,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Debora B. Thompson, CGWP
Senior Project Manager

James E. Mudge, Ph.D.
Principal Environmental Scientist

Kenneth R. Miller, P.E.
Vice President

Enclosure

cc: All Counsel/Parties of Record

L-96163.F29/206

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TABLE OF CONTENTS

FIGURES

EXHIBITS

TABLES

APPENDICES

1.0 INTRODUCTION

1.1 BACKGROUND

On September 7, 1994, a number of Potentially Responsible Parties (PRPs) entered into an Administrative Order on Consent (AOC) with the United States Environmental Protection Agency (USEPA) for the Granville Solvents Site (Granville site) pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Armco Inc. (Armco) elected not to sign the AOC with the other PRPs. Some of the PRPs that signed the AOC and are implementing the response actions at the site have filed a cost recovery lawsuit against Armco. Armco has retained Kirkpatrick & Lockhart LLP (K&L) as legal counsel on this matter. K&L contracted with Civil & Environmental Consultants, Inc. (CEC) to provide litigation support and prepare this expert report that presents CEC's opinions regarding response actions performed at the site.

1.2 OVERVIEW OF CERCLA

1.2.1 Purpose and Scope of CERCLA

CERCLA created a fund (the "Superfund) whose revenues were derived from a tax on crude oil and petroleum products and used to remedy certain significant environmental problems. CERCLA authorizes response actions to be taken either by governmental agencies or by private parties.

CERCLA required USEPA to develop the "National Oil and Hazardous Substances Pollution Contingency Plan" (NCP) to provide the basic regulatory requirements for actions under CERCLA. The NCP established a system (the "Hazard Ranking System") for assessing sites to prioritize them for site investigation and remediation.

The NCP also established procedures and standards for the assessment, investigation, and selection and implementation of CERCLA actions. The NCP also contains requirements for the Administrative Record which must be established by the lead agency in support of any response action selected.

CERCLA applies to the release or threat of release of any "hazardous substance." USEPA has defined "hazardous substance" by regulation to include a broad spectrum of materials, ranging from substances that are acutely toxic to those that are, actually, necessary to sustain human and plant life. For example, benzene, a known carcinogen, is a CERCLA hazardous substance, but zinc and chromium are also listed as "hazardous substances," even though they are essential to human health. USEPA's list of hazardous substances is published in Section 302.4 of its regulations.

The mere presence of a hazardous substance does not necessarily require response action under CERCLA. For example, although zinc is identified as a "hazardous substance," a response action for soils containing zinc at certain levels would not be appropriate. Zinc is an essential human nutrient and has a U.S. recommended dietary allowance that varies from 5 to 19 milligrams per day (mg/day). Therefore, consumption of small amounts of soil containing certain zinc levels may not harm (and might actually improve) human health. CERCLA response action in such circumstances is not appropriate.

CERCLA and the NCP only authorize response actions to deal with releases or threats of releases which may present an imminent and substantial danger to public health or the environment.

1.2.2 Types of CERCLA Response Actions

The NCP identifies two general categories of response actions - removal actions and remedial actions. The category of action appropriate for a particular site is determined by assessing whether risks are immediate or long-term, and whether the time needed for response is short or long. Removal actions are those that are implemented to respond to more urgent risks. Remedial actions are performed when there is sufficient time available to complete the investigation and analyses required by the NCP. NCP Section 400.315 identifies requirements for removal actions, while Section 400.330 identifies requirements for remedial actions. USEPA also has developed guidance documents for performing removal and remedial actions that are consistent with the NCP.

In 1992, USEPA proposed a new concept for addressing sites which was intended to accomplish the goal of expedited cleanup for some Superfund sites and increased efficiency in the Superfund process. This initiative is referred to as the Superfund Accelerated Cleanup Model (SACM). The SACM guidance, however, specifically requires that actions be performed in accordance with NCP requirements. Specifically, SACM states:

> SACM does <u>not</u> provide independent authority to carry out actions that are not authorized by CERCLA and the NCP regulations.
>
> For instance, the use of the terms "early actions" and "long-term actions" in SACM should not be read to mean that actions may be implemented under the SACM model that are other than removal or remedial actions. Any action taken under CERCLA must fall into the category of a removal action or a remedial action, and then must conform to applicable NCP requirements.

1.3 PURPOSES OF REPORT

The purposes of CEC's activities were to evaluate whether the response actions at the site were selected and implemented in accordance with CERCLA and NCP requirements and whether those actions were technically appropriate. This report presents CEC's opinion that the response actions at the Granville site were selected and performed in a manner inconsistent with requirements set forth in CERCLA and the NCP. Specifically, this report presents CEC's opinions, within a reasonable degree of certainty, that:

- The goals specified and response selected in the AOC are not supported by findings in the AOC or by the Administrative Record for the site;

- The findings and determinations in the AOC were insufficient to support selection and implementation of a response action;

- The findings and determinations in the AOC were not supported by the Administrative Record;

- The response actions taken by M&E at the site after September 7, 1994 were not consistent with the NCP;

- Because M&E did not follow NCP procedures, it is impossible to determine if the costs incurred by M&E at the site after September 7, 1994 were necessary costs of response;

- The response actions performed by M&E at the site were not "emergency" or "time-critical" in nature;

- The conditions at the site did not satisfy NCP factors to warrant performance of a removal action;

- The response actions performed by M&E were not of the type that should be classified as "removal";

- The response actions performed at the site fail to comply with the NCP requirements for removal actions in any event;

- The response actions performed by M&E fail to comply with the NCP requirements for performing remedial actions; and

- CEC also concluded that acetone was not actually a contaminant of concern at the site (although erroneously detected by M&E) and all costs incurred due to acetone detections were unnecessary and should not be recoverable under CERCLA.

1.4 BASES OF REPORT

Preparation of this report is based on CEC's review of the documents maintained in the Administrative Record for the Granville site by USEPA, and the documents produced by M&E to the document repository in the cost-recovery litigation (collectively referred to herein as the "Site materials"). Some of the Site materials are listed in Section 4.0 below, entitled "References." This report is also based on materials ordinarily relied upon by CEC personnel in performance of their profession and CEC's substantial experience in the investigation and remediation of dozens of CERCLA sites. Resumes of key CEC personnel are provided in Appendix A.

CEC performed no independent field investigation of conditions at or near the Granville site. CEC has assumed for the limited purpose of this report the accuracy of the facts set out in previous studies (except as specifically noted otherwise).

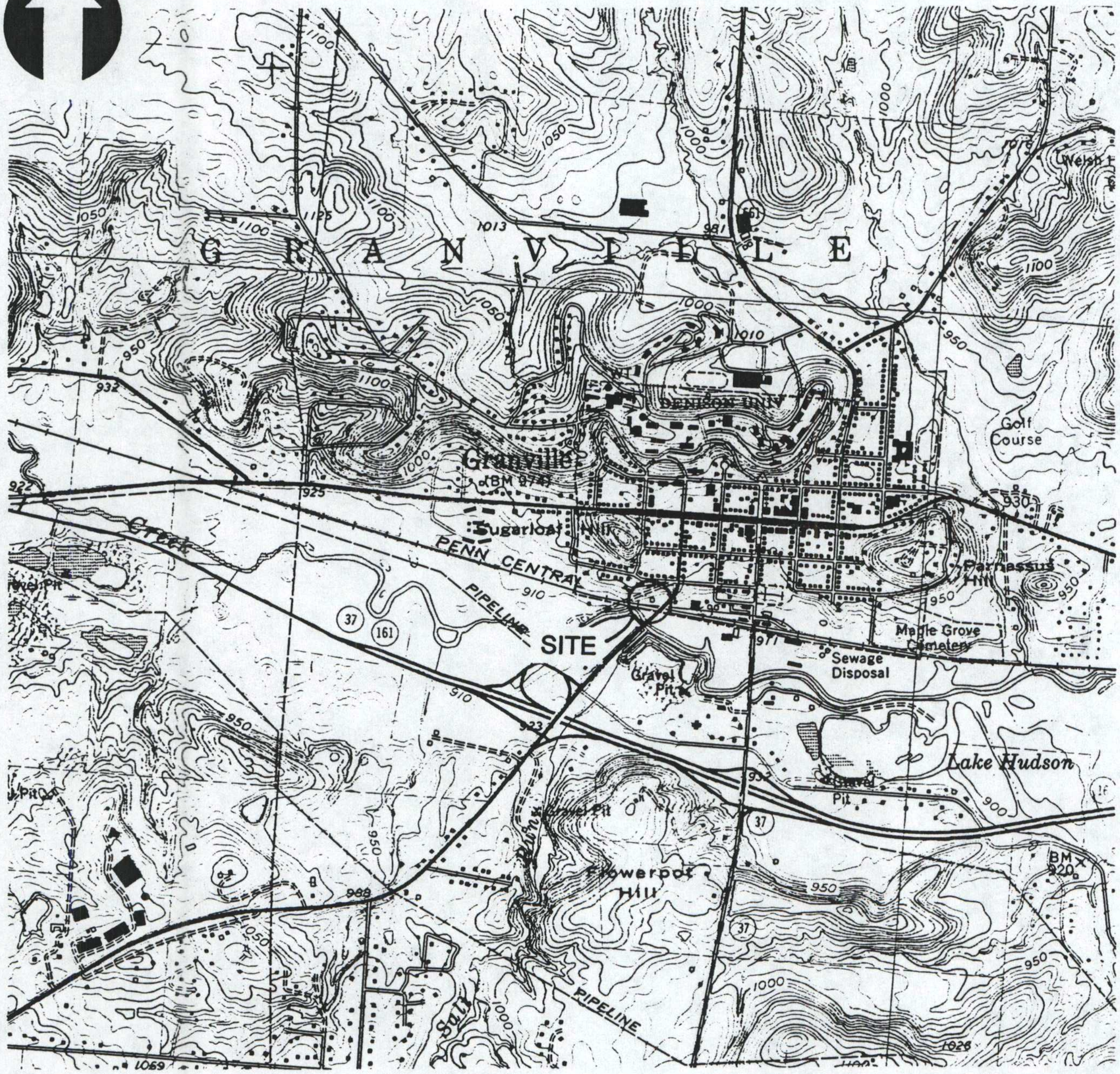
1.5 BRIEF SITE DESCRIPTION

This section of the report presents a summary of site location and layout, topography, site geology and hydrogeology, as presented in prior reports. The brief description that follows provides information that is necessary for a general understanding of site conditions related to response actions at the site and the discussion in this report.

1.5.1 Site Location and Layout

The Granville site is the location of a former solvent blending and recycling operation on Palmer Lane in the rural community of Granville, Licking County, Ohio. The site location is presented on Figure 1-1. The site is approximately one-third mile southwest of downtown Granville. The Granville site is in a primarily residential area that has some commercial and light industrial businesses nearby. The site is bordered to the north and west by Palmer Lane, to the west and south by a bicycle and walking path, and to the east by the former village of Granville water treatment plant and the Cherry Street overpass. The nearest business is a lumber yard on the east side of the former water treatment plant. The nearest residence is about 100 feet north of the Granville site atop a 40-foot bluff above the site. Raccoon Creek is approximately 100 feet south of the Granville site property, flowing from west to east.

The Village of Granville's municipal wellfield is approximately 1,000 feet west of the Granville site. The water production wells combined yield nearly 750,000 gallons per day for daily use. The production wells range in depth from 74 to 109 feet. Wells PW-1 and PW-2 were generally pumped several hours each day at 650 gallons per minute



REFERENCE: U.S.G.S 7.5' TOPOGRAPHIC MAP
GRANVILLE QUADRANGLE, OHIO
DATED: 1961, PHOTOREVISED: 1974; PHOTOINSPECTED 1984.

SCALE IN FEET
0 2000 4000

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SITE LOCATION
GRANVILLE SOLVENTS SITE

DWN. BY:	APPROVED BY:	SCALE:	DATE:		
CHKD. BY: KRM		1"=2000'	3/8/96	96163	FIGURE 1-1

(gpm) before PW-1 was removed from service in January 1994 at the recommendation of USEPA. Production well PW-3 yields less water and is generally pumped at 450 gpm.

1.5.2 Topography

The triangular Granville site property occupies approximately 1.5 acres. The northern portion of the property slopes south toward Raccoon Creek. The southern and lower portion of the site is relatively flat.

1.5.3 Site Geology and Hydrogeology

The Granville site is located in the glaciated section of the Central Lowlands physiographic province. The area is overlain by over 100 feet of materials deposited by Pleistocene glaciers. The site is situated over a preglacial valley that has been filled with approximately 200 feet of alluvium (Soller, 1986). Alluvium, which is sediment deposited by flowing water, consists primarily of sand and gravel overlain by five to 40 feet of silt.

These unconsolidated sediments form a single, unconfined aquifer. No private industrial or domestic water-supply wells tap this aquifer in the vicinity of the site. M&E's site investigations show this to be a highly productive water-bearing zone capable of supporting pumping rates of more than several hundred gallons per minute (gpm). A well completed in this aquifer can draw water from a large area. This unit provides water for the Village of Granville via the pumping wells described in Section 1.5.1.

Groundwater flow beneath the site is currently controlled by the Granville pumping wells and two extraction wells installed by M&E. In December 1994, M&E began to operate a pump and treat system in an attempt to control contaminant movement (Section 1.6.2). Pumping of these wells has further modified the groundwater flow pattern, drawing water towards the site and creating a groundwater divide which separates the site from the wellfield.

Before these wells were installed, groundwater flowed southward or southeastward, discharging into Raccoon Creek. With pumping of the wellfield, the groundwater flow direction changed to westward, toward the Granville wellfield. Because of changes in the pumping of these wells, the direction of groundwater flow has varied through time. The hydraulic interaction with Raccoon Creek may vary seasonally, with some water still discharging to the stream during wet seasons, and the creek recharging the groundwater system during drier seasons.

Groundwater quality in the vicinity of the site has been assessed by M&E and others through a network of 15 monitoring wells. Ohio Environmental Protection Agency (Ohio EPA), Compliance Solutions, and M&E found that the groundwater beneath the site contains substantial levels of chlorinated organic solvents. M&E identified that the limits of the plume extended to approximately 200 feet west of the Granville site. Downgradient wells MW-7, MW-7D, MW-8, and MW-8D - closest to the wellfield - are not contaminated above drinking water standards.

1.6 SITE HISTORY

1.6.1 Facility Operations

Granville Solvents, Inc. (GSI) began operations at another location in 1953 as a petroleum solvent storage, packaging, blending, and redistribution facility. GSI began operations at the Palmer Lane location (i.e., the Granville site) in 1958, where it continued the same activities until 1980. In 1980, GSI ceased its petroleum-related activities and began operating as a solvent reclamation and recycling facility for industrial solvent wastes. Solvents were stored in approximately fifteen 500-gallon to 5,000-gallon aboveground and underground storage tanks, as well as several hundred 55-gallon drums. Table 1-1 presents a summary of the site history.

1.6.2 Response Actions

Response actions have been conducted at the site by Ohio EPA, Clean Harbors, Compliance Solutions, USEPA, and M&E. A summary of the prior response actions is provided as Table 1-2. Of particular interest is the groundwater remediation system installed in December of 1994 by M&E.

The groundwater extraction and treatment system installed by M&E consists of two extraction wells (EW1 and EW2) equipped with submersible pumps, a low profile air stripper, transfer pumps, and transfer piping. M&E documents indicate that pumping rates for extraction wells EW1 and EW2 averaged 200 gpm and 90 gpm respectively from the commencement of system operations in December 1994 through mid-February 1995. Pumping rates for each extraction well averaged 90 gpm from mid-February through mid-April of 1995. Based on influent and effluent analysis results from the groundwater pump and treat system, an estimated 60 pounds of organic compounds were removed from the site groundwater between mid-December 1994 and mid-April 1995.

1.7 REQUIREMENTS OF THE ADMINISTRATIVE ORDER BY CONSENT

A Group of PRPs (including the plaintiffs in the cost-recovery litigation) have entered into the AOC with USEPA. USEPA executed the AOC on September 7, 1994. The AOC specifies the response to be performed by the PRPs for the Granville site, requiring the PRPs to take the following actions (among others):

TABLE 1-1
GRANVILLE SOLVENTS SITE
SITE HISTORY

TIME PERIOD	DESCRIPTION
1953	Granville Solvents Inc. (GSI) began operations as a petroleum solvent storage, packaging, blending, and distribution facility.
1958	GSI moved its operations to the Palmer Lane site (i.e., the "Granville site"), and continued the same activities until 1980.
1980	GSI ceased its petroleum-related activities and began operating as a solvent reclamation and recycling facility for generators of industrial solvent waste.
1980	GSI submitted a Resource Conservation and Recovery Act (RCRA) Part A Permit Application to operate under interim status.
1982	Ohio EPA conducted a RCRA compliance inspection and noted several violations. Violations included: storing more waste than allowed for facilities with interim status; inadequate waste container storage practices; leaking and open containers; inadequate contingency plan; and failure to implement spill prevention measures.
1983	GSI submitted a RCRA Part B Permit Application to EPA indicating that the facility was seeking a permit as a treatment, storage, or disposal facility. EPA found this application to be inadequate.
1984	GSI submitted a revised Part B Permit Application, which EPA also determined to be deficient.
1984	GSI submitted a closure plan, and a revised closure plan, for a portion of the site. The closure plans stated that the facility would continue operations as a transfer and storage facility.
1985	GSI submitted a revised Part B Permit Application which EPA again found to be inadequate.
August 1986	The Licking County Court of Common Pleas ordered GSI to cease operations because of non-compliance with Ohio EPA's financial responsibility regulations. GSI ceased operations, but continued to store hazardous waste at the facility.
1986	Ohio EPA inspected the site and found that closure activities had been initiated but were incomplete.
1987	Ohio EPA inspected the site and found violations of Land Disposal Restriction (LDR) regulations and RCRA container storage requirements.
July 17, 1987	EPA formally denied GSI's application for a Part B hazardous waste permit and ordered that a closure plan for the entire facility be submitted. GSI failed to submit the closure plan.

TIME PERIOD	DESCRIPTION
November 9, 1988	EPA issued a complaint, findings of violations, and a compliance order that required GSI to submit a closure plan.
March 17, 1989	GSI submitted a closure plan for the site to Ohio EPA. Ohio EPA did not approve the plan because it did not meet performance standards set forth by the Ohio Administrative Code. GSI did not submit a modified closure plan claiming that it had insufficient funds to cleanup the site.

TABLE 1-2
GRANVILLE SOLVENTS SITE
PRIOR RESPONSE ACTIONS

TIME PERIOD	DESCRIPTION
August 30, 1985	Ohio EPA conducted a Preliminary Assessment of the Granville site. The preliminary assessment indicated that the site handled methanol and chlorinated volatile organic compounds (VOCs) such as methylene chloride, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, and trichlorofluoromethane. The report stated that the facility was regulated under RCRA and no portion of the property was known to have been used as an unregulated hazardous waste site. As a result, the Preliminary Assessment report concluded that, until closure or abandonment of the facility occurred, additional actions pursuant to CERCLA and the NCP were inappropriate.
October 19, 1988	The USEPA Technical Assistance Team (TAT) conducted a Site Assessment. TAT concluded that 25,600 gallons of containerized waste remained onsite and the site was not adequately protected against trespassers, contaminant release, or fire. TAT recommended that USEPA conduct a removal action.
January 8, 1990	Ohio EPA conducted a revised/updated Preliminary Assessment of the Granville site. The report documenting this Assessment is not part of the Administrative Record for the site. However, it is believed that Ohio EPA recommended the site for a state-lead interim action. The interim action included characterization and removal of all containerized waste; excavation, cleaning and removal of storage tanks; installation of monitoring wells; and sampling of onsite soils to address a perceived immediate risk to human health.
June 1990	Clean Harbors began the investigation and cleanup of the Granville site. Work was performed under Mobilization Order 145-01 from Ohio EPA dated March 13, 1990. Clean Harbors installed four monitoring wells (MW-1 through MW-4). These monitoring wells were not sampled by Clean Harbors. Clean Harbors also performed some cleaning of storage tanks during this effort. Ohio EPA later contracted with Compliance Solutions Inc. to complete the cleanup.
January 30, 1991	Ohio EPA collected and analyzed groundwater samples from MW-1 through MW-4. Reports indicate that several chlorinated VOCs were detected in the groundwater samples.
February 18, 1991	Compliance Solutions, Inc. began work at the site to complete work started by Clean Harbors, including: removal and disposal of empty drums and hazardous waste drums; decontamination of tanks, warehouse, and distillation building; removal and disposal of tanks and waste water from decontamination activities; backfill of the tank excavation pits; and site restoration.
March 26, 1991	Ohio EPA collected and analyzed groundwater samples from MW-1 through MW-4. Reports indicate that several chlorinated VOCs were detected in the groundwater samples.
May 20, 1991	Compliance Solutions completed work onsite regarding the decontamination of various buildings, disposal of wastewater, backfilling of tank excavation pits, and site restoration.
June 26, 1991	Compliance Solutions began installation of five additional monitoring wells, bringing the total number of wells at the site to nine.
October 1, 1991	Compliance Solutions installed monitoring well MW-6, bringing the total number of wells at the site to ten.

TIME PERIOD	DESCRIPTION
October 8, 1991	Ohio EPA collected and analyzed groundwater samples from ten monitoring wells. Reports indicate that several chlorinated VOCs were detected in the groundwater samples.
January 22, 1992	Ohio EPA collected and analyzed groundwater samples from nine monitoring wells. Reports indicate that several chlorinated VOCs were detected in the groundwater samples.
May 4, 1992	Compliance Solutions began installation of five additional monitoring wells, bringing the total number of wells at the site to fifteen.
June 18, 1992	Compliance Solutions collected and analyzed groundwater samples from 13 monitoring wells and Granville pumping well PW-1. Reports indicate that several chlorinated VOCs were detected in the groundwater samples near the site. VOCs were not detected in the monitoring wells furthest from the site (MW-7, MW-7D, MW-8, and MW-8D) or in PW-1.
August 26, 1992	Compliance Solutions submitted "Granville Solvents Interim Action Final Report," prepared under Ohio EPA Mobilization Order #145-02.
January 13, 1993	Compliance Solutions submitted "Granville Solvents Interim Action Final Report," prepared under Ohio EPA Mobilization Order #145-03. This document indicated that the objective of the work which had been performed by Compliance Solutions was to provide additional information to estimate the vertical and horizontal extent of the groundwater contamination relative to the Granville wellfield.
April 27, 1993	Groundwater samples were collected from MW-7, MW-7D, MW-8, and MW-8D, and analyzed for VOCs. Reports indicate that cis-1,2-dichloroethene (cis-1,2-DEC) and trans-1,2-dichloroethene (trans-1,2-DCE) were detected in MW-8 at 28 and 3 μg/l, respectively.[1]
May 25, 1993	PRC Environmental Management visited the Granville site to conduct a Site Inspection for USEPA.
August 5, 1993	Groundwater samples were collected from MW-7 and MW-8 and analyzed for VOCs by Ohio EPA. Reports indicate that 1,2-DCE (total) was detected at 25 μg/l at MW-8. Total 1,2-DCE represents the sum of cis-1,2-DCE and trans-1,2-DCE.
November 3, 1993	Groundwater samples were collected from Granville Well PW-1 and MW-8 and analyzed for VOCs by Ohio EPA. No VOCs were detected in Granville Well PW-1. Reports indicate that cis-1,2-DCE was detected at 37.2 μg/l, trans-1,2-DCE was detected at 4.7 μg/l, and 1,1-DCE was detected at 1.8 μg/l.
November 29, 1993	PRC Environmental Management, Inc. submitted to USEPA a "Screening Site Inspection Site Evaluation Report" for the Granville site. The report presented PRC's evaluation of the site conditions and the contaminant migration and exposure pathways associated with the site.

[1] μg/l represents micrograms per liter, which is commonly referred to as parts per billion. For illustrative purposes, a part per billion would be similar to taking 1 teaspoon of 1,2-dichloroethene and placing it into a pool of water the size of a football field (50 yards x 120 yards, including end zones) that is over 4 feet in depth.

TIME PERIOD	DESCRIPTION
January 1994	Ohio EPA recommended that the Village of Granville remove pumping well PW-1 from service to reduce potential capture of impacted groundwater. The Village of Granville stopped pumping from PW-1.
January 1994	USEPA proposed that potentially responsible parties (PRPs), who allegedly shipped solvent material to the Granville site, execute an Administrative Order on Consent (AOC) for interim response actions with USEPA.
February 1994	A group of PRPs formed the Granville Solvents PRP Group and met with USEPA to discuss the AOC. The PRPs employed Metcalf & Eddy to provide technical support.
March 1994	Metcalf & Eddy began site work to collect the data to evaluate the site for additional response actions.
April and May 1994	Metcalf & Eddy conducted field investigations to further define the extent of contaminants in soil and groundwater. The Metcalf & Eddy investigation detected acetone in groundwater samples, although acetone had not previously been identified as a contaminant in prior investigations at the site.
April 28, 1994	Metcalf & Eddy submitted Revision 2 of the "Draft Work Plan, Interim Response Action," to USEPA. This Work Plan estimated the time of travel from MW-8 to PW-1 to be 2.2 years; however, the estimate did not consider retardation or dispersion of the constituents which lengthens the travel time. The Work Plan also laid out an investigation program for the site that included a soil gas survey, geoprobe groundwater headspace sampling, soil sampling, and Hydropunch groundwater sampling (a prior draft of this Work Plan was submitted on April 13, 1994).
September 7, 1994	Plaintiffs and other PRPs entered into the AOC with USEPA. Armco, Inc. did not sign the AOC.
October 28, 1994	Metcalf & Eddy submitted a Technical Memorandum to USEPA. The stated purpose of the Technical Memorandum was to provide a discussion of the basis for design of the groundwater extraction and treatment system. The document stated that the response action had been separated into four elements by the USEPA in the AOC: (1) Groundwater Extraction and Treatment system to be implemented prior to December 20, 1994 to halt further migration of contaminated groundwater; (2) Protection of the Village of Granville's drinking water supply; (3) Source Area Groundwater Extraction and Treatment System for the long-term remediation of the aquifer; and (4) Source Area Soil Remediation to protect underlying groundwater and human health and the environment. The Technical Memorandum described Metcalf & Eddy's design of the groundwater extraction and treatment system and generally described the performance standards and objectives of the remaining three elements. The performance standards of the groundwater extraction and treatment system were stated as follows: (1) prevent further migration of groundwater contamination (originating form the site) toward the Village of Granville municipal wellfield; and (2) Treat and discharge all extracted water as required by the Work Plan and the AOC. Alternatives mentioned in the Technical Memorandum included: Groundwater Sparging Coupled with Soil Vapor Extraction; Source Area Groundwater Pump and Treat; Groundwater Sparging, Soil Vapor Extraction, Coupled with Groundwater Pump and Treat; Well Head Treatment at Village Well PW-1; and Source Area Groundwater Pump and Treat in Conjunction with Well Head Treatment at Village Well PW-1.

TIME PERIOD	DESCRIPTION
December 20, 1994	Reportedly, a groundwater extraction and treatment system began operation.
July 6, 1995	Metcalf & Eddy submitted to USEPA "Technical Evaluation of Alternatives to Reinstate the Capacity of the Village of Granville Water Supply Well, PW-1." This document provides Metcalf & Eddy's technical evaluation of alternatives to reinstate the capacity of the Village of Granville water supply well, PW-1. Three alternatives were evaluated: (1) taking no further action at the site and allowing PW-1 to operate as normal; (2) treating groundwater pumped from PW-1 that could potentially become contaminated with VOCs; and (3) replacing the capacity of PW-1 with another supply well located upgradient, west of the wellfield. The no further action alternative involved relying on GSS-EW1 from the existing extraction system to act as a hydraulic barrier between the site and the Village wellfield. The treatment alternative involved installing systems to treat the groundwater pumped from PW-1. The document stated that the alternatives were evaluated using the nine criteria established by the NCP for remedial actions. Metcalf & Eddy's evaluation of these technologies concluded that relocation of PW-1 was most effective for satisfying the criteria of the NCP.
July 19, 1995	Metcalf & Eddy submitted to USEPA "Treatability Performance Report of the Groundwater Treatment System." This was a Performance Report that presented the performance results of the groundwater treatment system.

TIME PERIOD	DESCRIPTION
July 24, 1995	Metcalf & Eddy submitted a Revised Work Plan to USEPA. The Revised Work Plan identified the work to be performed as consisting of four major work elements: (1) install and run a groundwater extraction and treatment system to control the further migration of contaminated groundwater; (2) implement appropriate action that, in the event any contaminated groundwater originating from the site enters the Granville wellfield, the municipal drinking water supply continues to meet all risk-based and all applicable federal and state drinking water standards; (3) design, install, and operate a groundwater extraction and treatment system to control the migration of contaminated groundwater that has the capacity to treat groundwater within the contaminant plume to "no-further-action levels;" and (4) treat soils to levels that attain risk-based standards and federal and state ARARs, and to levels that assure that no groundwater beneath the soils will become contaminated in excess of the groundwater "no-further-action levels." The document stated the performance standards for the groundwater extraction and treatment system as follows: (1) prevent further migration of groundwater contamination (originating from the site) toward the Village of Granville municipal wellfield; and (2) treat and discharge all extracted water as required by the Work Plan and the AOC. The response action alternatives mentioned by Metcalf & Eddy included groundwater sparging coupled with soil vapor extraction; source area groundwater pump and treat; groundwater sparging, soil vapor extraction, and source area groundwater pump and treat; wellhead treatment at Village well PW-1; and source area groundwater pump and treat in conjunction with wellhead treatment at Village well PW-1. The criteria purportedly used to evaluate the alternatives included the following: control the further migration of the contaminant plume in groundwater originating from the site; treat the drinking water supply as necessary to meet ARARs; cleanup the contaminant plume in groundwater to meet "no-further-action levels;" treat soils to meet "no-further-action levels;" implementability (technical and administrative feasibility); federal/state acceptability; and community acceptability. These criteria do not match NPC requirements. Metcalf & Eddy identified source area pump and treat in conjunction with wellhead treatment as the preferred alternative. The approach for meeting the requirements of site soils was to conduct treatability studies and investigations to collect additional data. Prior drafts of this Work Plan were submitted to USEPA on October 19 and November 18, 1994, and January 31 and May 19, 1995.
July 25, 1995	Metcalf & Eddy submitted a Groundwater Monitoring Program Plan, which described the implementation of a performance monitoring network for the groundwater extraction and treatment system. New groundwater monitoring wells and piezometers were proposed to be installed and sampled reportedly to refine the evaluation of the impacted plume of groundwater and to verify the performance of the groundwater extraction and treatment system. A regular sampling program was proposed using some of the existing wells and new wells in order to attempt to detect any changes in the plume configuration and concentrations. Prior drafts of this Groundwater Monitoring Program Plan were submitted to USEPA on March 15, April 11, and June 12, 1995.

TIME PERIOD	DESCRIPTION
December 8, 1995	Metcalf & Eddy submitted to USEPA "Revised Design Technical Memorandum for the Remediation of Impacted Soils" at the Granville Solvents Site. The objective of the Design Technical Memorandum (DTM) was stated to be to present an overview of the current plans to address the impacted soils at the Granville Solvents site. The document included a summary of background information and available soil data, risk-based preliminary remediation goals (PRGs) for contaminants in the site soils, preliminary evaluation and screening of candidate remedial alternatives for the impacted soils, and a plan for the collection of additional site soil data to assist in the evaluation, analysis, and design of a remedial alternative for the GSS soils. Prior drafts of this Technical Memorandum were submitted to USEPA on July 6 and August 31, 1995.

- "By December 20, 1994, install and run a groundwater extraction and treatment system which shall halt the migration of groundwater contamination (originating from the Site) toward the Village of Granville municipal wellfield...."

- "[I]mplement action which is necessary to ensure that any water contaminated with any contamination (originating from the Site) that enters the Village of Granville municipal wellfield drinking water supply meets all risk-based and all applicable federal and state drinking water standards. ... Such action shall be implemented at the Village of Granville municipal wellfield to the extent necessary both to reinstate fully the capacity of PW-1 prior to its reactivation and to the extent necessary to prevent any loss in the Village of Granville municipal wellfield drinking water supply capacity ... caused, in whole or part, because of contamination (originating from the Site), or the threat thereof, entering the Village of Granville municipal wellfield water supply...."

- "Design, install and operate a groundwater extraction and treatment system which shall halt the migration of groundwater contamination (originating from the Site) toward the Village of Granville municipal wellfield and shall treat all groundwater within the contamination plume originating from the Site to no further action levels which assure protection of human health and the environment and attain all risk-based standards and federal and state ARARs...."

- "Treat soils at the Site to levels which will assure protection of human health and the environment, to levels which will attain all risk-based standards and federal and state ARARs, and to levels which will assure, to the maximum extent practicable, that no groundwater beneath the soils will become contaminated above the groundwater no further action levels....."

The AOC also makes a number of findings and determinations that are discussed below in Section 2.1 of this report.

2.0 THE RESPONSE SELECTED IN THE AOC WAS NOT BASED ON FINDINGS SUPPORTED BY THE ADMINISTRATIVE RECORD AND WAS TECHNICALLY INAPPROPRIATE

2.1 THE FINDINGS AND DETERMINATIONS IN THE AOC ARE NOT SUPPORTED BY THE ADMINISTRATIVE RECORD AND/OR DO NOT WARRANT A REMOVAL OR REMEDIAL ACTION

As part of this project, CEC reviewed the Administrative Record compiled by USEPA for the Granville site. NCP Section 300.800(a) requires USEPA to "establish an administrative record that contains the documents that form the basis for the selection of a response action." The NCP also defines what types of documents should be made part of the Administrative Record (Record) in Sections 300.810, 815, and 820.

The opinions stated in this section of this report are based on CEC's review of the Administrative Record for the Granville site as it is concluded to have existed at the time that USEPA executed the AOC (September 7, 1994) based on the date of the documents. No site materials outside the Record were considered or relied on in forming the opinions expressed in this section.

The Record does not contain all of the information necessary to validate the accuracy of the site characterization data in it. Chain-of-custody documentation that should be in the Record for that data is missing. There is no reference in the Record index as to where those materials may be found, if they exist. Furthermore, to the extent that the AOC predetermined the remedy for the site, and that the remedy is concluded to be a remedial action rather than a removal action, the site characterization data relied upon to make the selection should have been of a Data Quality Objective Level IV. In the absence of that documentation or reference to it, CEC concludes that the site characterization data in the Record are not properly supported. For this reason, the findings or determinations in the AOC are not properly supported. The site characterization data in the Record, even if accepted, do not support the findings and determinations or the response selected as summarized in the following subsections of this report.

2.1.1 AOC Finding 9

Finding of 9 in the AOC states: "The hazardous substances, pollutants and contaminants at and originating from the Site pose a continued threat of exposure to the nearby human and animal population and the ecosystem via the water supply to the Granville Municipal wellfield, off-site migration of contamination, and direct contact." CEC concludes that Finding 9 is insufficient to support the response actions taken, and does not warrant the implementation of a CERCLA removal or remedial action. As indicated previously in this report, CERCLA response actions are taken to assure protection of human health and the environment. The mere presence of a hazardous substance, pollutant, or contaminant in a medium, and the mere potential of exposure to any of those substances does not automatically trigger a need for a response action.

Further, the Record that is believed to have been in place as of September 7, 1994 does not support a conclusion that the wellfield, offsite migration of contaminants, and direct contact pose an imminent or substantial endangerment to public health or the environment. The Record does not contain a risk evaluation, groundwater flow velocity estimates, fate and transport assessments of contamination, or data to show that contamination was being withdrawn by the pumping wells and distributed into the municipal system. In fact, the Administrative Record does not show that contaminants had ever been detected at pumping well PW-1, or that groundwater at MW-7 and MW-8 failed to meet drinking water standards.

2.1.2 AOC Determination 6

Determination 6 in the AOC states: "The conditions present at the Site constitute a threat to public health, welfare, or the environment based upon the factors set forth in section 300.415(b)(2) of the [NCP] ...." Upon review of the Record, CEC concludes that Determination 6 is insufficient in the context of CERCLA response action. The subsections of Determination 6 are addressed in the following items:

2.1.2.1 Finding of actual or potential exposure to nearby humans, animals or the food chain

USEPA determined in the AOC that actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants or contaminants is a factor present at the Site. To support this determination, USEPA noted the detection of certain chemicals in the groundwater and surface soils in the vicinity of the Site and presumed exposure to those chemicals through the municipal wellfield, surface water in Raccoon Creek, or surface soils on the adjacent bike path or the Site itself. CEC concludes that this determination is insufficient to justify CERCLA removal or remedial actions because there is no evaluation of whether the potential exposure would exceed acceptable limits as defined in the NCP.

As indicated in Section 2.1.1, the mere presence of hazardous substances, pollutants, and contaminants, or the mere potential exposure to those materials, is insufficient to justify taking a CERCLA response action. Documents or analyses, such as a risk assessment, that could support such a finding and provide the justification for a CERCLA removal or remedial action were not present in the Record.

2.1.2.2 Finding of actual or potential contamination of drinking water supplies or sensitive ecosystems

USEPA determined in the AOC that actual or potential contamination of drinking water supplies or sensitive ecosystems is a factor present at the Site. To support this determination, USEPA noted the detection of certain chemicals in the groundwater and surface soils in the vicinity of the Site and presumed exposure to those chemicals through the municipal wellfield, surface water in Raccoon Creek, or surface soils on the adjacent bike path or the Site itself.

CEC again concludes that this factor is insufficient to support a CERCLA removal or remedial action because potential contamination is not sufficient to support a CERCLA removal or remedial action without any consideration of potential health risks. There is no basis in the Record for determining any actual contamination of drinking water supplies or sensitive ecosystems. Groundwater quality at monitoring wells (MW-7 and MW-8 series), located several hundred feet from pumping well PW-1 (which had already been shut off), met drinking water standards. The Record that should support the AOC does not reveal any contamination in the public water supply or that it would be in the public water supply in the near future. Additionally, as is discussed in Part 2.1.1 above, USEPA's determinations are not supported by any fate and transport analysis or calculation of exposure point concentrations, rendering the determination of potential contamination unsupportable in the Record.

2.1.2.3 Finding of high levels of contamination in surface soils that may migrate

USEPA determined in the AOC that high levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate, is a factor present at the Site. To support this determination, USEPA noted the detection of certain chemicals in the surface soils at the Site and the fact that "[p]recipitation frequently occurs in Granville."

CEC concludes that the mere finding of the presence of contaminants in the soils is meaningless and insufficient to justify a removal or remedial action. A demonstration of a risk to human health or the environment must be demonstrated for this to be meaningful. The Record does not include documentation to show how this factor would be meaningful. There is no assessment of the contaminant migration potential or an evaluation of potential resultant exposure magnitude, frequency, or duration. Additionally, there is no risk evaluation to support a demonstration that those soils present an unacceptable risk to human health or the environment. CEC is not aware of any CERCLA sites where precipitation events do not occur. The use of precipitation as a justification for the removal action is inappropriate.

2.1.2.4 Finding of weather conditions that may cause the release of contaminants

USEPA determined in the AOC that weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or to be released are present at the Site. To support this determination, USEPA noted again the detection of certain chemicals in surface soils and groundwater at the Site and the fact that precipitation occurs in Granville, Ohio. CEC is not aware of any CERCLA sites where precipitation events do not occur. The use of precipitation as a justification for the removal or remedial action is inappropriate. Upon review of the Site materials, CEC concludes that this determination is insufficient to warrant implementation of a CERCLA removal or remedial action.

2.1.2.5 Finding of unavailability of other response mechanisms

USEPA determined in the AOC that the unavailability of other appropriate federal or state response mechanisms to respond to the release is a factor that supports the actions required by the AOC. To support this determination, USEPA noted that Ohio EPA previously expended approximately $1 million performing a removal action at the Site and has no additional resources to address Site conditions further. CEC was unable to identify any documents in the Record to support that conclusion. There were no documents indicating that Ohio EPA had no resources to address the site beyond the $1 million previously expended. Even if Ohio EPA had no resources to address the site, this finding by itself does not warrant the implementation of a removal or remedial action, without consideration of what (if any) health risks were being mitigated.

Moreover, the Record contains no support for a conclusion that the Granville public water supply system would have been unable to meet its obligations under the Safe Drinking Water Act to provide potable water to its users.

2.1.3 AOC Determination 7

Determination 7 in the AOC states: "The actual or threatened release of hazardous substances from the Site may present an imminent and substantial endangerment to the public health, welfare, or the environment within the meaning of section 106(a) of CERCLA, 42 U.S.C. § 9606(a)." CEC concludes that Determination 7 is not supported by information contained in the Record. In particular, the Record contains insufficient support for a determination of any "imminent" or "substantial" threat to any receptor from the release of any hazardous substance from the Site. No analysis of contaminant fate and transport, or quantification of risk, is provided in the Record to allow evaluation of whether an imminent or substantial endangerment may exist.

2.1.4 AOC Determination 8

Determination 8 in the AOC states: "The removal actions required by this Order are necessary to protect the public health, welfare, or the environment ...." As stated previously, no evaluation of risks to public health or the environment was found in the Record. CEC concludes that Determination 8 (that the specific actions required by the AOC were necessary) is not supported by information contained in the Record.

2.2 ELEMENTS OF THE RESPONSE SELECTED IN THE AOC ARE NOT SUPPORTED BY THE ADMINISTRATIVE RECORD

Certain elements of the response as specified in Section V.2 of the AOC are not supported by the Record as it existed on September 7, 1994. As with the evaluations in Section 2.1, K&L requested CEC to perform this analysis based on the Record as of the date of the AOC. This subsection identifies elements of the response that are not supported by the Record.

2.2.1 No Remedy Should Have Been Specified

Risks to human health and the environment that could warrant response action are not identified in the Record. Therefore, specification of any removal or remedial action was inappropriate and unsupportable. The Record shows only that contaminants had been identified at the site, but the nature and extent of the contamination had not been assessed. Migration of contaminants had not been characterized, including migration pathways and receptors identification in accordance with standard practice. Additionally, risks had not been quantified in excess of a level where unacceptable risks to human health and the environment were present. Imminent or substantial hazards were not identified. There is no justification for the requirement for any removal or remedial action.

2.2.2 Groundwater Extraction and Treatment System Shall Halt Migration

AOC Section V.2.e and f specify that a groundwater extraction and treatment system be installed and operated to halt migration of groundwater contamination toward the Village of Granville municipal wellfield. This element of the remedy is not supported by the Record.

There was no information in the Record to demonstrate the need to halt groundwater flow towards the wellfield. The Record did not contain groundwater flow data or fate and transport assessments of the contaminants to show that contamination of the water supply would occur. Additionally, there was no risk assessment to demonstrate the need to take actions to prevent ingestion of contaminated groundwater to protect human health.

2.2.3 Treatment of Site Soils

Section V.2.g specifies that soils at the site be treated "to levels which will assure protection of human health and the environment..." This portion of the remedy is not supported by the Record because it pre-determines that some soil treatment is necessary. There were no documents in the Record that identify risks associated with those soils or that they were continuing to contribute contamination to groundwater. As a result, the Record did not demonstrate why this element of the response was needed.

2.3 THE RESPONSE SELECTED IN THE AOC WAS TECHNICALLY INAPPROPRIATE

This section differs from Sections 2.1 and 2.2 because the evaluations contained herein make use of all Site materials, not just the Record. As a result, it considers the body of information collected during M&E's ongoing activities at the site.

Evaluation of the Site materials does not support the need for the "immediate" halting of contaminant migration to prevent ingestion of contaminated water. M&E's analysis of record was limited to calculation of groundwater travel times and ascribing those as contaminant migration times. M&E's report acknowledges that this analysis did "not consider retardation or dispersion of the constituents which may actually increase the travel time." The analysis also did not consider mixing at the wellhead. As will be discussed in Section 3.2.3 of this report, assessment of these factors shows that unacceptable levels of contaminants would not be expected to reach the wellfield for many years.

Furthermore, "halting" of migration is not necessary to protect human health and the environment. Through natural attenuation mechanisms, an aquifer can reduce contaminant concentrations to acceptable levels as groundwater flows. Some contaminant migration can therefore occur without posing a risk to human health or the environment. Additionally, human health can be protected with wellhead treatment, which is a proven and cost-effective method of providing safe drinking water.

Finally, in the fall of 1994, sufficient data did not exist to permit the design of a response guaranteed to "halt" the migration of contaminants.

3.0 ACTIONS TAKEN WERE INCONSISTENT WITH THE NCP AND THE RELATED COSTS WERE NOT NECESSARY

3.1 THE DIFFERENCE BETWEEN REMOVAL AND REMEDIAL ACTIONS

As indicated earlier in this report, requirements are established in the NCP and USEPA guidance documents for two general categories of response actions: removal actions and remedial actions. The category of action appropriate for a particular site is established through assessment of whether risks are immediate or long-term, and the time period over which response actions will be implemented. Removal actions are classified as "emergency," "time-critical," and "non-time-critical" by USEPA. USEPA's Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA specifies that emergency and time-critical removal actions respond to releases requiring action in less than six months, and that non-time-critical removal actions respond to releases requiring response in greater than six months. Remedial actions are performed when several years or more are available for response.

The requirements for emergency and time-critical removal actions are more flexible so that agencies and other parties can respond to emergency conditions without significant administrative constraints and delays. This flexibility, however, is appropriate only if emergency or time-critical conditions exist. Where a planning period of at least six months exists, Section 300.415(b)(4) of the NCP requires the performance of certain activities, including an engineering evaluation/cost analysis (EE/CA), even if a removal action is the appropriate response. When a remedial action is appropriate, significantly greater investigation and analysis is required.

As is discussed below, the conditions at the Granville site did not justify performance of a removal action after Ohio EPA completed its removal action. The site conditions did not present an immediate threat necessitating expedited response. Nonetheless, M&E and USEPA selected and undertook response actions without performing necessary remedial action requirements. M&E and USEPA also did not perform removal action requirements necessary to the type of response undertaken.

3.2 THE RESPONSE ACTION DOES NOT QUALIFY AS A REMOVAL ACTION

3.2.1 An Emergency or Time-Critical Response Was Not Needed

This section of the report presents information to support the conclusion that activities at the site were neither emergency nor time-critical in nature. This conclusion is supported by site characterization data and the previous response actions taken.

3.2.1.1 Site Groundwater Data

M&E's conclusion about the rate of contaminant movement in the groundwater indicates that emergency or time-critical actions were not necessary. M&E concluded that it would take two years beyond May 1994 for contamination to reach the easternmost pumping well (PW-1, which had been removed from service) and over three years to reach pumping well PW-2. That two to three year time period exceeds the six month period specified in the NCP and the guidance documents for emergency and time-critical actions, and indicates at most that a non-time-critical removal action was appropriate. Moreover, CEC's analysis of groundwater data as described in Section 3.2.3.1 suggests that much more than two years would have been necessary for any significant contamination to reach the pumping wells. This time would have been sufficient to permit appropriate remedial action study.

If the detection of acetone in the wellfield west of PW-1 caused parties to consider the response actions to be emergency or time-critical actions, this was based on technical errors. As discussed in Section 3.2.3.2, CEC concludes the acetone plumes identified by M&E were not representative of actual site conditions.

3.2.1.2 Timing of Prior Response Actions

Review of the site history (Table 1-1) and the prior response actions (Table 1-2) also demonstrates the conditions at the Granville Solvents Site did not require emergency or time-critical response actions. The long period of agency involvement - which consisted of almost three years (January 1991 through November 1993) during which groundwater monitoring only was performed - strongly suggests that the groundwater issues at the site could have been addressed by remedial action. The AOC negotiations also consumed a substantial period of time (roughly eight months). This extensive period of agency involvement is not consistent with M&E's implementation of a removal action, much less of an emergency or time-critical response action.

3.2.2 Site Conditions Did Not Satisfy the NCP Factors Necessary to Proceed with a Removal Action

Section 300.415(b)(2) of the NCP identifies eight factors that must be considered in determining the appropriateness of removal actions (see Table 3-1). The mere presence of these conditions, however, does not indicate that removal action is appropriate. In fact, several of the factors are present at most hazardous waste sites, including sites where the remedial action process is used.

Five of the eight NCP factors are cited in Section IV, Item 6 of the AOC, in what seems to be an attempt to validate the need for a removal action at the site by simply indicating their presence. The five factors are identified in the AOC as being present at the site and as providing support for the removal action; however, the data and analyses that could substantiate these factors are absent from the findings of the AOC

TABLE 3-1
GRANVILLE SOLVENTS SITE
FACTORS TO BE CONSIDERED IN DETERMINING THE APPROPRIATENESS OF A REMOVAL ACTION

- Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;
- Actual or potential contamination of drinking water supplies or sensitive ecosystems;
- Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;
- High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate;
- Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;
- Threat of fire or explosion;
- The availability of other appropriate federal or state response mechanisms to respond to the release; and
- Other situations or factors that may pose threats to public health or welfare or the environment.

Reference: 40 CFR 300.415(b)(2)[(i) through (viii)]

R-96163.T31/206

(and from the Administrative Record). These five factors were discussed previously in Section 2.1. There is no discussion of the other three factors.

As discussed in Section 3.2.3.1 of this report, an evaluation of the fate and transport characteristics of the groundwater contaminants using groundwater modeling techniques would have identified that there was no imminent or substantial risk to the Granville water supply, particularly in light of the cessation of pumping at PW-1. The groundwater modeling demonstrates that groundwater quality would remain above drinking water standards, even assuming that water was removed and ingested directly from PW-1. As a result, it does not appear there was an imminent or substantial threat to public health, welfare, or the environment from groundwater at the site. There also was no documentation reviewed by CEC that demonstrated an imminent threat from soil contamination at the site.

3.2.3 Site Data Do Not Support the NCP Factors

3.2.3.1 Contaminant Fate and Transport

There was no reasonable technical basis for concluding that the Granville site posed an imminent threat to the wellfield. Although, as discussed previously, M&E calculated a travel time from MW-8 to the wellfield of 2.2 years, its analysis was flawed because contaminant-migration did not consider factors which attenuate the movement and concentrations of contaminants in groundwater: retardation, dispersion, and mixing. M&E simply calculated the time it would take for groundwater to travel to PW-1, not the time it would take for contaminants to travel to PW-1 at certain concentrations of concern. M&E noted that these other factors would serve to increase (lengthen) the travel time of contaminants, but it did not take them into account when calculating the travel time. These factors should be considered when attempting to calculate a contaminant migration rate. Without considering such factors, no justifiable conclusion can be drawn regarding the "imminence" of any "threat" to public health, welfare or the environment through an identified pathway.

M&E also did not consider the effects of groundwater mixing that occurs when water is extracted by wells. Water entering a pumping well flows radially, bringing in water from all directions. A contaminant plume within the capture zone of a pumping well will contribute only a portion of the water extracted by the well, and contaminant concentrations will be reduced by mixing with water from other parts of the aquifer. This mixing effect is enhanced when water from multiple pumping wells is combined in a holding vessel prior to distribution to the public. The Granville Solvents site intercepts approximately 10 degrees of arc for a circle centered on PW-1, so the contaminant plume would be expected to contribute about 10/360, or 3%, of the flow to the pumping well. The mixing effect at other Granville wells, which are located further from the site, would be even greater. Failure to consider these groundwater mixing effects prevented accurate evaluation of the "imminence" of any perceived "threat" to public health, welfare or the environmental through the Granville pumping wells.

CEC employed analytical contaminant-transport modeling to preliminarily evaluate expected concentrations at the Granville pumping wells. An equation for three-dimensional advective-dispersive transport developed by Domenco & Robbins (1985) was used, and retardation was incorporated. Prediction of concentrations at specific times is complicated by a lack of information on when contaminants first reached the water table. This analytical model is appropriate for initial evaluation of contaminant migration, but does not include factors such as mixing, infiltration, and changes in groundwater flow velocity (A more sophisticated model accounting for these other factors was employed, as well, and is discussed below.)

The groundwater flow velocity was set at 0.6 ft/day, based on the gradient before PW-1 was taken out of service. This value is consistent with the velocity used by M&E in calculating travel times. Retardation was calculated based on a conservatively low estimate of the aquifer organic carbon content of 0.05%. Analyses were performed for the dominant contaminants identified in onsite groundwater: tetrachloroethylene (PCE), trichloroethylene (TCE), and 1,1,1-trichloroethane (TCA). Maximum Contaminant Levels (MCLs) are established by USEPA as drinking-water standards for contaminants. The MCLs for these compounds are: 5 μg/l for PCE, 5 μg/l for TCE, and 200 μg/l for TCA.

Source concentrations were inserted to allow concentrations similar to the maximum levels observed onsite at a distance of one foot from the source (Tables 3-2, 3-3, and 3-4). These simulations show that contaminants are expected to be below MCLs at PW-1 (1,400 feet from the site) over 12 years after source initiation. This is the predicted condition with PW-1 pumping, which is not the current condition. Contaminants are expected to be below MCLs at PW-2 even 20 years after source initiation. When mixing at the pumping well is considered, as described above, contaminants would be expected to be not only below MCLs, but also below detection limits, in water extracted from PW-1 20 years after the initiation of contaminant release. Although groundwater velocities will increase as water approaches the pumping well, CEC's sensitivity analysis showed that this effect, within the range of likely values, is not substantial.

Modeling of cis-1,2-dichloroethylene was not performed because it occurs onsite at lower concentrations than PCE, TCE, and TCA; its MCL is much higher than TCE and PCE; and it is expected to move at a rate similar to the other compounds.

To further evaluate potential contaminant migration from the site, CEC performed limited digital computer modeling. Digital modeling can assess dilution of

TABLE 3-2
ANALYTICAL MODEL OF PCE CONCENTRATIONS

Contaminant-Transport Evaluation
Advective-Dispersive Transport with Retardation

Site:	*Granville Solvents*
Project No.:	*96163*
Analysis by:	*dbl*
Description:	*PCE Concentrations, Calibrated Source*
27-Feb-96	

INPUT DATA:

SOURCE DESCRIPTION

- Compound.......... *Tetrachloroethylene*
- Source Concentration.......... *30,000.0* ug/l
- Octanol/Water Partitioning Coefficient.......... *7.59E+02*

AQUIFER DESCRIPTION

- Fraction Organic Carbon.......... *0.05%*
- Bulk Density.......... *120* lb/ft^3
- Porosity.......... *30%*
- Source Width.......... *20* ft
- Flow Velocity.......... *6.00E-01* ft/day
- Penetration Depth.......... *2* ft
- Transverse Dispersivity.......... *20* ft
- Vertical Dispersivity.......... *20* ft
- Longitudinal Dispersivity.......... *90* ft

PROBLEM SETUP

- Maximum time for calculations.......... *7300* days
- Maximum distance for calculations.......... *1900* ft

CALCULATED VALUES:

- Distribution Coefficient (Kd).......... 2.4E-01 ml/g
- Retardation Coefficient (Rd).......... 2.5
- Longitudinal Dispersion (Dx).......... 54.000 ft^2/day
- Transverse Dispersion(Dy).......... 12.000 ft^2/day
- Vertical Dispersion (Dz).......... 12.000 ft^2/day
- Retarded Flow Velocity.......... 2.37E-01 ft/day

TIME (days)	TIME (years)	CONCENTRATION (ug/l) AT DISTANCE(ft)				
		1	475	950	1425	1900
1	0.00	760.2	0.0	0.0	0.0	0.0
487	1.33	1,116.0	0.2	0.0	0.0	0.0
973	2.67	1,228.5	0.9	0.0	0.0	0.0
1,460	4.00	1,304.3	1.5	0.1	0.0	0.0
1,947	5.33	1,360.5	1.9	0.3	0.0	0.0
2,433	6.67	1,404.2	2.3	0.5	0.1	0.0
2,920	8.00	1,439.0	2.6	0.6	0.1	0.0
3,407	9.33	1,467.2	2.8	0.8	0.2	0.0
3,893	10.67	1,490.3	3.0	1.0	0.3	0.1
4,380	12.00	1,509.5	3.2	1.1	0.4	0.1
4,867	13.33	1,525.5	3.3	1.2	0.5	0.2
5,353	14.67	1,538.9	3.4	1.3	0.6	0.2
5,840	16.00	1,550.2	3.5	1.4	0.6	0.3
6,327	17.33	1,559.6	3.5	1.5	0.7	0.3
6,813	18.67	1,567.9	3.6	1.6	0.8	0.4
7,300	20.00	1,574.8	3.7	1.6	0.8	0.4

TABLE 3-3
ANALYTICAL MODEL OF TCE CONCENTRATIONS

Contaminant-Transport Evaluation
Advective-Dispersive Transport with Retardation

Site:	*Granville Solvents*
Project No.:	*96163*
Analysis by:	*dbl*
Description:	*TCE Concentrations, Calibrated Source*
27-Feb-96	

INPUT DATA:

SOURCE DESCRIPTION

Compound	*Trichloroethylene*
Source Concentration	*80,000.0* ug/l
Octanol/Water Partitioning Coefficient	*1.95E+02*

AQUIFER DESCRIPTION

Fraction Organic Carbon	*0.05%*
Bulk Density	*120* lb/ft³
Porosity	*30%*
Source Width	*20* ft
Flow Velocity	*6.00E-01* ft/day
Penetration Depth	*2* ft
Transverse Dispersivity	*20* ft
Vertical Dispersivity	*20* ft
Longitudinal Dispersivity	*90* ft

PROBLEM SETUP

Maximum time for calculations	*7300* days
Maximum distance for calculations	*1900* ft

CALCULATED VALUES:

Distribution Coefficient (Kd)	6.1E-02 ml/g
Retardation Coefficient (Rd)	1.4
Longitudinal Dispersion (Dx)	54.000 ft²/day
Transverse Dispersion(Dy)	12.000 ft²/day
Vertical Dispersion (Dz)	12.000 ft²/day
Retarded Flow Velocity	4.31E-01 ft/day

TIME	TIME	CONCENTRATION (ug/l) AT DISTANCE(ft)				
(days)	(years)	1	475	950	1425	1900
1	0.00	3,343.3	0.0	0.0	0.0	0.0
487	1.33	5,723.5	2.4	0.0	0.0	0.0
973	2.67	6,304.8	8.3	0.5	0.0	0.0
1,460	4.00	6,597.6	12.5	2.0	0.1	0.0
1,947	5.33	6,760.5	15.1	3.9	0.6	0.0
2,433	6.67	6,854.6	16.7	5.5	1.5	0.2
2,920	8.00	6,910.3	17.7	6.8	2.5	0.6
3,407	9.33	6,943.5	18.3	7.7	3.4	1.1
3,893	10.67	6,963.3	18.6	8.4	4.2	1.8
4,380	12.00	6,975.2	18.9	8.8	4.8	2.4
4,867	13.33	6,982.3	19.0	9.0	5.3	2.9
5,353	14.67	6,986.4	19.1	9.2	5.6	3.4
5,840	16.00	6,988.9	19.1	9.3	5.9	3.8
6,327	17.33	6,990.3	19.2	9.4	6.0	4.0
6,813	18.67	6,991.1	19.2	9.5	6.2	4.3
7,300	20.00	6,991.6	19.2	9.5	6.2	4.4

TABLE 3-4
ANALYTICAL MODEL OF TCA CONCENTRATIONS

Contaminant-Transport Evaluation
Advective-Dispersive Transport with Retardation

Site:	*Granville Solvents*
Project No.:	*96163*
Analysis by:	*dbl*
Description:	*TCA Concentrations, Calibrated Source*
27-Feb-96	

INPUT DATA:

SOURCE DESCRIPTION

Compound	*1,1,1-Trichloroethane*
Source Concentration	*20,000.0* ug/l
Octanol/Water Partitioning Coefficient	*1.48E+02*

AQUIFER DESCRIPTION

Fraction Organic Carbon	*0.05%*
Bulk Density	*120* lb/ft³
Porosity	*30%*
Source Width	*20* ft
Flow Velocity	*6.00E-01* ft/day
Penetration Depth	*2* ft
Transverse Dispersivity	*20* ft
Vertical Dispersivity	*20* ft
Longitudinal Dispersivity	*90* ft

PROBLEM SETUP

Maximum time for calculations	*7300* days
Maximum distance for calculations	*1900* ft

CALCULATED VALUES:

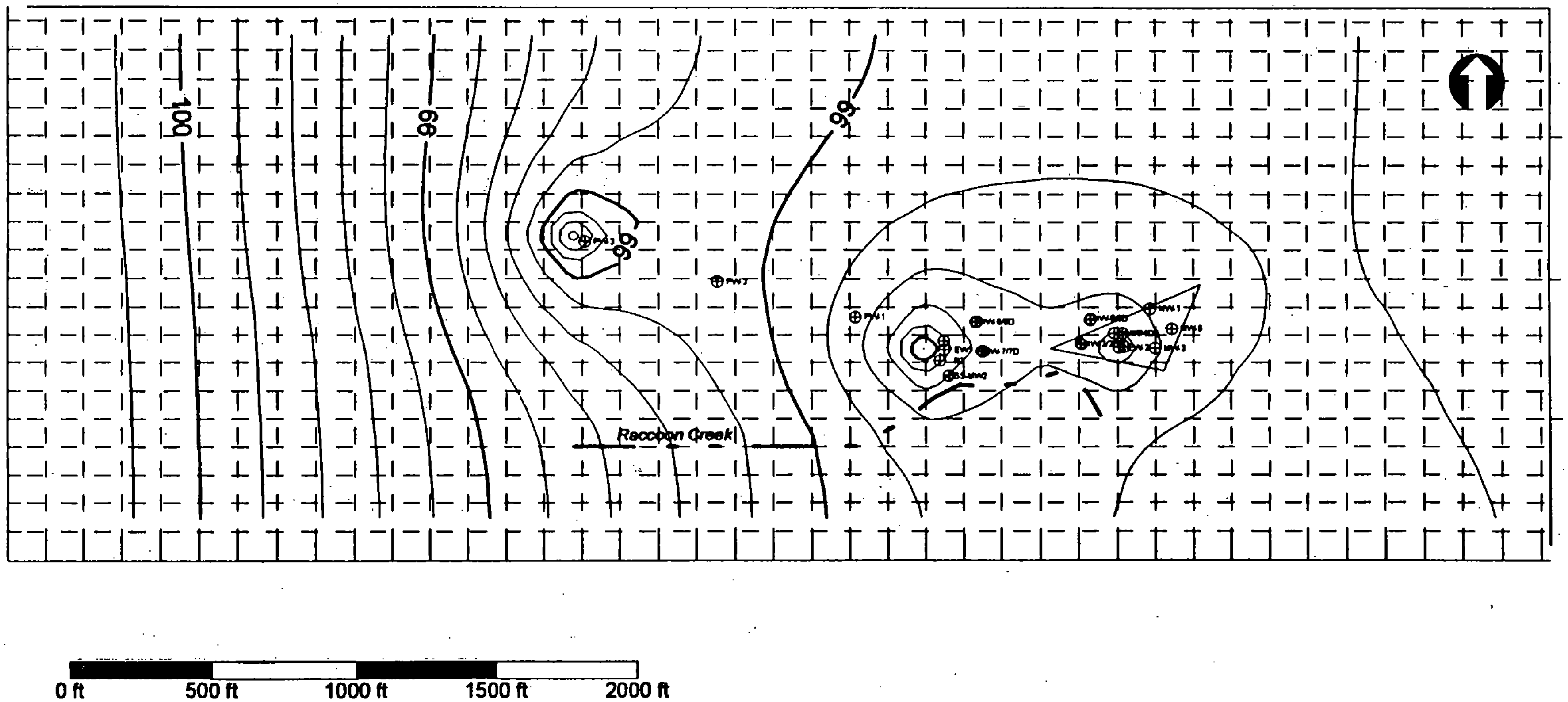
Distribution Coefficient (Kd)	4.7E-02 ml/g
Retardation Coefficient (Rd)	1.3
Longitudinal Dispersion (Dx)	54.000 ft²/day
Transverse Dispersion(Dy)	12.000 ft²/day
Vertical Dispersion (Dz)	12.000 ft²/day
Retarded Flow Velocity	4.62E-01 ft/day

TIME (days)	TIME (years)	CONCENTRATION (ug/l) AT DISTANCE(ft)				
		1	475	950	1425	1900
1	0.00	884 0	0.0	0 0	0.0	0.0
487	1.33	1,541.1	0.7	0.0	0.0	0.0
973	2.67	1,691 5	2.4	0.2	0.0	0.0
1,460	4.00	1,762.6	3.6	0.6	0.0	0.0
1,947	5.33	1,799.6	4 2	1.2	0.2	0.0
2,433	6.67	1,819.6	4.6	1 6	0.5	0.1
2,920	8.00	1,830.7	4.9	2.0	0.8	0.2
3,407	9.33	1,836.8	5.0	2.2	1.0	0.4
3,893	10.67	1,840.1	5.1	2.3	1.2	0 6
4,380	12.00	1,842.0	5.1	2.4	1.4	0.7
4,867	13.33	1,843.0	5.1	2.5	1.5	0.9
5,353	14.67	1,843.5	5.1	2.5	1.6	1.0
5,840	16.00	1,843.8	5.1	2.5	1.6	1.1
6,327	17.33	1,844.0	5.2	2.6	1.7	1.2
6,813	18.67	1,844.0	5.2	2.6	1.7	1.2
7,300	20.00	1,844.1	5.2	2.6	1.7	1.2

contaminants and variable flow velocities better than the analytical model described above. The digital model can also use present conditions (rather than source initiation) as a starting point. The code employed was the Method of Characteristics model developed by the U.S. Geological Survey (Konikow and Bredehoeft, 1978).

The digital model was set up using the same parameters at the analytical model. Raccoon Creek was included via a leakance value. A surface recharge (infiltration) value was assigned based on the radius of influence from M&E's pump tests. Limited calibration was performed by duplicating the results of M&E's long-term pump test. A more detailed calibration could be performed with additional data. The leakance value assigned to Raccoon Creek, which regulates the rate at water can infiltrate, was adjusted until the drawdown from the pump test was reasonably approximated (Figure 3-1).

Starting concentrations for the digital model were based on M&E's April and May 1994 sampling results. A continuous contaminant injection point was placed on site to maintain concentrations at the location of MW-2 at their 1994 concentrations. This was done as a conservative measure to incorporate an assumption that soils will not be remediated. The flow field was set up to simulate pre-1994 pumping of the well field, with PW-1 and PW-2 providing the primary water source to the town. Contaminant migration is thus simulated in time after 1994 under the condition of no-action - the source remains active and wellfield pumping is not adjusted to reduce contaminant migration. As a further conservative assumption, PW-1 remains in constant use for this scenario. The model is two-dimensional, so contaminant concentrations are averaged over the full thickness of the aquifer. Starting concentrations were assigned as vertically weighted averages based on M&E's Hydropunch data.



Contour interval = 0.1 feet

FIGURE 3-1
CALIBRATED MODEL
FOR M&E PUMP TEST

96163
2/27/96
dbt

The simulation was first run for PCE. Predicted concentrations through time at MW-8 and PW-1 are presented in Figure 3-2. Even at the end of a 20-year simulation beginning in 1994, concentrations at PW-1 are predicted to be below MCLs. Furthermore, monitoring well MW-8 provides early detection of contaminant migration, with PCE levels at that well exceeding the MCL more than seven years before exceedances should occur at the pumping well.

A second simulation was performed to assess TCE migration. Concentrations at PW-1 are predicted to exceed MCLs approximately ten years into the simulation, which begins in 1994 (Figure 3-3). Again MW-8 provides warning approximately seven years before PW-1 is endangered.

An additional simulation was run to show the effects of shutting off PW-1 when the MCL for TCE is exceeded at MW-8 (Figure 3-4). Under these conditions, an acceptable water supply would have been maintained until after the year 2020.

3.2.3.2 Acetone Detected by M&E in the Vicinity of the Wellfield

High concentrations of acetone were reported for groundwater samples during M&E's Hydropunch investigations in April and May 1994. Acetone was reported at concentrations of up to 12,000 μg/l onsite and 1,300 μg/l offsite. Most significant to protection of the Granville wellfield, acetone was reported at concentrations of about 700 μg/l within 70 feet of PW-1, and at lower concentrations 100 feet west of PW-1. M&E concluded that two areas of elevated acetone contamination were present: an area near and including the Granville Solvents property, and an area mid-way between the site and the Granville wellfield. These conclusions regarding the extent of acetone contamination are presented on Figure 9 of the Technical Memorandum (October 28, 1994).

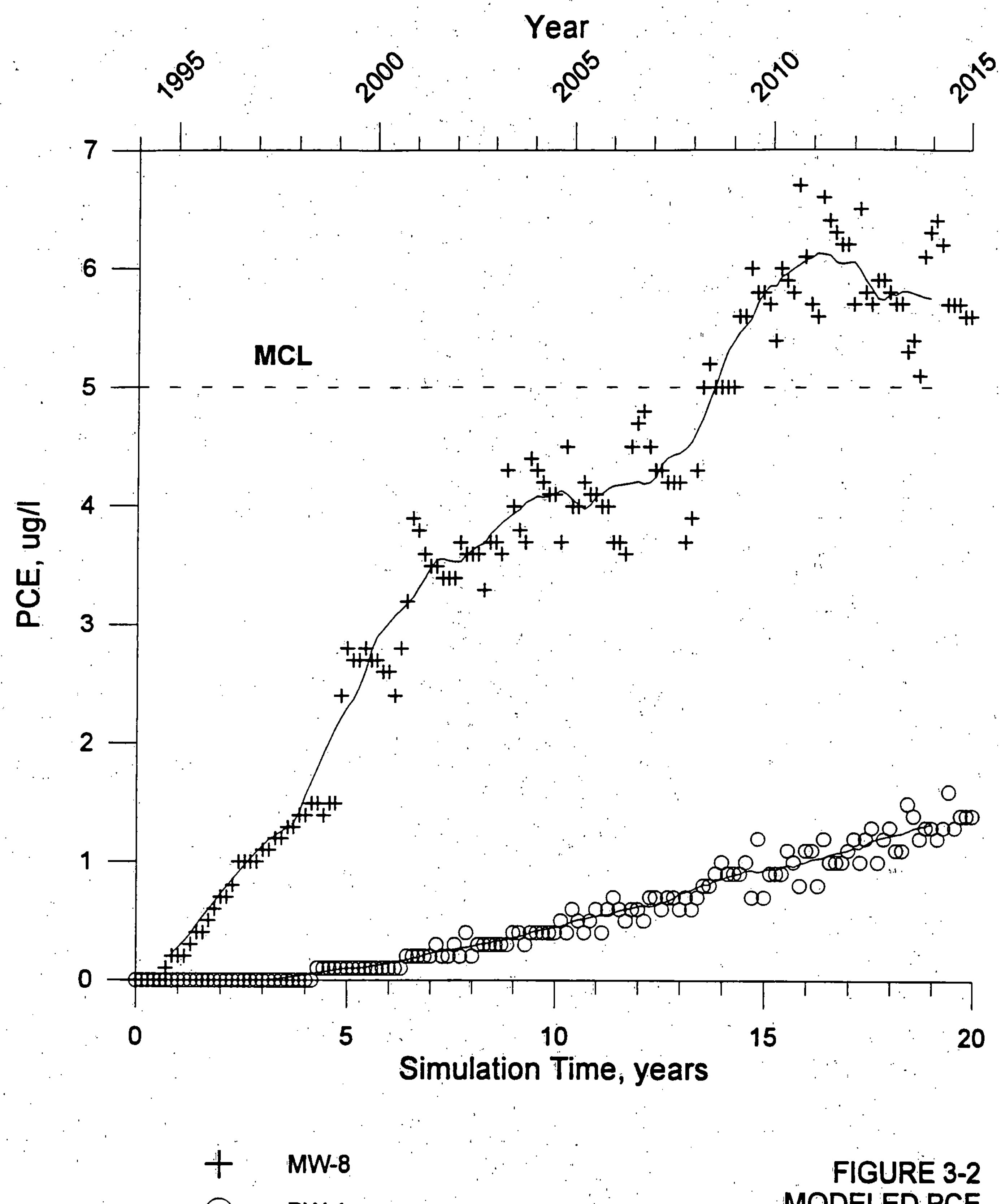


FIGURE 3-2
MODELED PCE
CONCENTRATIONS

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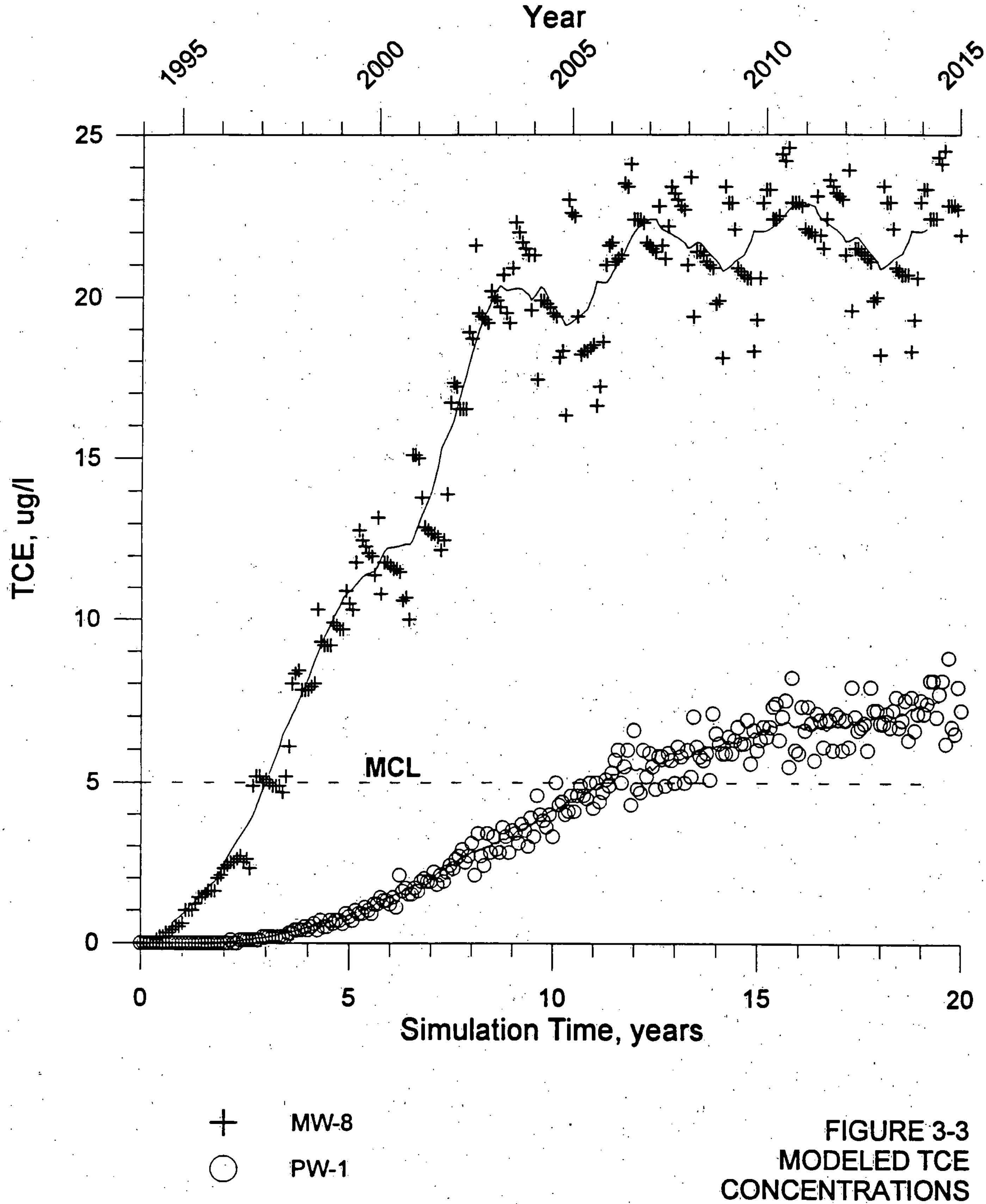

FIGURE 3-3
MODELED TCE
CONCENTRATIONS

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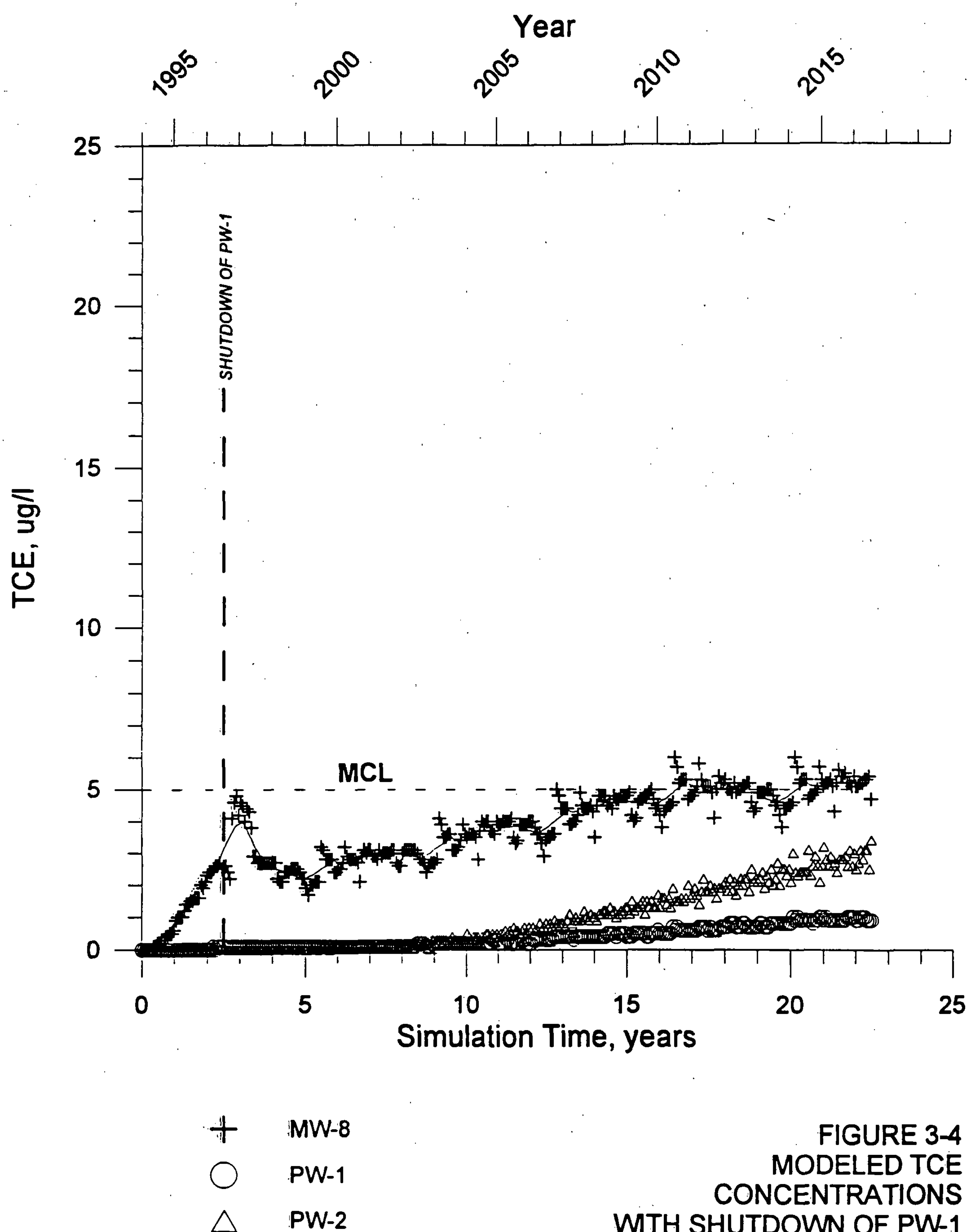

FIGURE 3-4
MODELED TCE
CONCENTRATIONS
WITH SHUTDOWN OF PW-1

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CEC's review of information on the hydropunch investigation and historic sampling indicates that the acetone was not representative of site conditions. M&E reported that isopropyl alcohol, which typically contains acetone as an impurity, was used for equipment decontamination during the hydropunch investigation. The report on the investigation indicates that a problem was identified with the decontamination procedure which resulted in the detection of acetone even in blank samples (blank samples consist of ultra-pure water which has been rinsed across decontaminated sampling equipment, and are analyzed to assess the effectiveness of the decontamination procedure). The decontamination procedure was modified to eliminate the use of isopropyl alcohol, but only after most of the Hydropunch investigation was completed.

Additionally, historic sampling data does not suggest that acetone was a site-related compound since it was not detected at significant concentrations during any sampling events prior to, or after, the hydropunch work. The 1985 Preliminary Assessment by Ohio EPA did not identify acetone as a chemical being stored in tanks at the site. Acetone was analyzed but was not detected in site soils during work by Clean Harbors in 1990. Sampling of the wastes in the tanks (and rinse waters from cleaning of the tanks) also was analyzed but did not detect acetone during work performed by Clean Harbors and Compliance Solutions. Initial site investigations and groundwater sampling efforts performed by Compliance Solutions and Ohio EPA did not detect any acetone at the site. Because acetone had never been detected at the site prior to the hydropunch investigation, M&E should have immediately questioned the detection of acetone at concentrations as high as 12,000 μg/l as a potential contaminant introduced by their investigation methods.

Subsequent investigations by M&E included analysis of groundwater from extraction wells EW-1 and EW-2. EW-2 is located onsite in the center of the alleged acetone contaminant plume identified by M&E on the site. EW-1 is located adjacent to the alleged offsite acetone plume identified by M&E. Analysis of discharge from the extraction wells from samples after December 20, 1994, when the system began operating, did not detect acetone above 1 $\mu g/l$.

CEC concludes that the acetone plumes identified in M&E's Technical Memorandum (10/28/94) are in error and do not represent actual site conditions. CEC reached this conclusion because acetone was identified at substantial concentrations only during the Hydropunch investigations when a known acetone source - isopropyl alcohol - was used in investigations. Given the inconsistencies between the Hydropunch investigations and all of the other site data collected by Clean Harbors, Compliance Solutions, and Ohio EPA, resampling should have been conducted before any activities were undertaken on the basis of those findings. It appears from the Site materials reviewed by CEC, however, that no resampling was conducted before M&E acted on the acetone findings.

3.2.3.3 Cost Allocation Considerations

As discussed in the preceding sections of this report, response actions at the site were performed in a manner that was inconsistent with requirements set forth in the NCP. Assuming that some of the costs incurred were consistent with the NCP and were necessary, it is CEC's opinion that costs related to acetone are divisible as to Armco, since Armco did not generate acetone that was disposed at the site.

3.3 M&E AND USEPA FAILED TO COMPLY WITH NCP REMOVAL ACTION REQUIREMENTS

Section 3.2 of this report demonstrated that the response action does not qualify as a removal action. Even if it did qualify as a removal action, the requirements for a removal action were not followed. The requirements for removal actions are set forth in Section 300.415 of the NCP.

3.3.1 Non-Time-Critical Removal Action Requirements

Section 3.2.1 of this report provided documentation to show that the response actions implemented at the site, even if appropriately classified as removal actions, could only be non-time-critical removal actions. Section 300.415(b)(4) of the NCP requires that an EE/CA be performed to support selection of non-time-critical removal actions. Additionally, the performance of an EE/CA is clearly identified in the USEPA Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA. The Site Materials clearly show that those requirements were not followed in performance of this project.

Not following the NCP requirements for EE/CAs led to several errors. The magnitude of these errors is considerable.

- USEPA and M&E did not consider fate and transport associated with the groundwater contaminants to allow determination of exposure point concentrations.

- USEPA and M&E failed to perform a streamlined risk evaluation to assess potential health risks of groundwater ingested from pumping well PW-1 (or from any other pumping well in the vicinity of the site where groundwater ingestion could occur).

- USEPA and M&E failed to develop appropriate removal action objectives.

- The limited array of alternatives prepared by M&E did not provide a sufficient range of alternatives for consideration.

- USEPA and M&E were unable to adequately evaluate the effectiveness of the limited array of alternatives that were developed (i.e., overall protection of human health and the environment) as a result of not having a streamlined risk evaluation to guide the removal efforts.

- USEPA and M&E failed to consider cost as a removal action selection criterion.

The remainder of this subsection identifies the major components of EE/CAs that were not performed on this project, along with a description of how the deficiencies led to selection and implementation of inappropriate response actions. Exhibit 3-1 presents an EE/CA outline from USEPA's Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA.

3.3.1.1 Streamlined Risk Evaluation

Requirements: USEPA's Guidance on Conducting Non-Time-Critical Removal Actions indicates that the streamlined risk evaluation is intermediate in scope between a limited risk evaluation undertaken for emergency removal actions and the conventional baseline risk assessment conducted for remedial actions. The streamlined risk evaluation provides justification for performing a removal action and identifies what current or potential exposures should be prevented. The risk evaluation uses sampling data from the site to identify the chemicals of concern, provides an estimate of how and to what extent people might be exposed to these chemicals, and provides an assessment of the health effects associated with these chemicals. A streamlined risk evaluation projects the potential risk of health problems occurring if no cleanup action

EXHIBIT 3-1
EE/CA OUTLINE

- Executive Summary
- Site Characterization
  - Site description and background
  - Previous removal actions
  - Source, nature, and extent of contamination
  - Analytical data
  - Streamlined risk evaluation
- Identification of Removal Action Objectives
  - Statutory limits on removal actions
  - Determination of removal scope
  - Determination of removal schedule
  - Planned remedial activities
- Identification and Analysis of Removal Action Alternatives
  - Effectiveness
  - Implementability
  - Cost
- Comparative Analysis of Removal Action Alternatives
- Recommended Removal Action Alternative

Reference: USEPA Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA, Exhibit 5 is taken at the site. For the EE/CA, the streamlined risk evaluation should focus on the specific problem that the removal action is intended to address.

Groundwater Response Actions: No streamlined risk evaluation was performed to support the installation of a groundwater pumping and treatment system. No VOCs were ever identified in PW-1. Groundwater quality at MW-7 and MW-8 also met drinking water standards. As described in Section 3.2.3, the groundwater contaminants would remain below levels of potential concern for many years, even assuming the point of uptake at pumping well PW-1. The AOC predetermined the groundwater remedy to be implemented at the Granville site, without any apparent consideration of risks that may be posed by the site.

Soil Response Actions: M&E apparently performed a risk-based screening evaluation of contamination migrating from site soils to groundwater in order to establish preliminary remediation goals (PRGs). However, this evaluation was performed after the AOC was signed, and therefore could not have been considered for the important initial decision of whether any soil response action was needed. As is stated in Section 1.7 above, the AOC requires treatment of soils. Moreover, M&E's risk evaluation of site soils failed to consider other aspects of response selected in the AOC, including the groundwater pump and treat system which created a hydraulic divide that cut the pathway of exposure upon which the evaluation was predicated.

M&E's risk-based screening evaluation was inappropriate for technical reasons as well. The preliminary remediation goals were controlled by the soil to groundwater migration pathway using protection of groundwater at the site above risk-based standards as the criterion. M&E conceded that the soil screening levels (SSLs), which were later used as PRGs, were derived assuming conservative default leach-based fate and transport processes which do not incorporate site-specific information.

This risk evaluation resulted in overly conservative standards for the soil remediation because no groundwater consumption occurs at the Granville site. The risk-based levels for protection of human health were generally orders-of-magnitude higher than those allowed by the overly conservative soil to groundwater migration analyses.

3.3.1.2 Identification of Removal Action Objectives

Requirements: Section 2.5 of USEPA's Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA states that identifying the scope, goals, and objectives for a removal action is a critical step in the EE/CA. The guidance states that where the lead agency determines there is a threat to public health, welfare, or the environment, a removal action may be taken to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or threat of release. The removal action objectives should be achieved by meeting specified cleanup levels while attaining ARARs to the extent practical.

Groundwater Response Actions: As discussed in the preceding subsection, no risk evaluation was performed to support the development of removal action goals and objectives. As a result, the documents discussing the groundwater response actions provide overly broad removal action objectives. For example, M&E's October 28, 1994 Technical Memorandum and July 24, 1995 Work Plan, stated that the performance standards of the groundwater extraction and treatment system were: (1) to prevent further migration of groundwater contamination (originating from the site) toward the Village of Granville municipal wellfield; and (2) to treat and discharge all extracted water as required by the Work Plan and the AOC.

The NCP does not support performance standards that do not consider risks to human health or the environment.

Soil Response Actions: The Design Technical Memorandum for the Remediation of Impacted Soils provides a limited risk evaluation to support the development of removal action goals and objectives; however, the use of the soil to groundwater migration pathway combined with the assumption that groundwater is consumed at the site again results in development of overly broad removal action objectives/preliminary remediation goals.

3.3.1.3 Identification of Removal Action Alternatives

Requirements: Section 2.6 of USEPA's Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA specifies that a few relevant and viable removal alternatives should be chosen for evaluation and comparison. The guidance also notes that "if the information ... to evaluate action alternatives is not sufficient, or if data quality is suspect, OSCs/RPMs should collect any additional technical information needed." Another USEPA guidance document regarding presumptive remedies specifies that, as part of the EE/CA process, the no action alternative should be considered along with presumptive remedies and other alternatives.

Groundwater Response Actions: The Technical Memorandum (dated October 28, 1994) provided a summary of alternatives that were considered for the groundwater extraction and treatment system. The alternatives included groundwater sparging coupled with soil-vapor extraction; source area groundwater pump and treat; groundwater sparging, soil-vapor extraction coupled with groundwater pump and treat; wellhead treatment at Village Well PW-1; and source area groundwater pump and treat in conjunction with wellhead treatment at Village Well PW-1.

The documents addressing the groundwater response action did not identify and carry the no action alternative through the alternative evaluation and comparison process. Additionally, although guidance indicates that only a few alternatives need to be identified, the alternatives identified clearly indicate that the response action was predetermined. The AOC had already specified that a groundwater pump and treat system would be installed. At a minimum, there were several variations of pumping and treatment schemes that should have been considered in addition to the scheme that was implemented.

Soil Response Actions: The Design Technical Memorandum for the Remediation of Impacted Soils at the Granville site dated December 8, 1995, identified a number of remedies. No remedy has been selected. The alternatives do not include "no action" as an alternative for consideration.

3.3.1.4 Analysis of Removal Action Alternatives

Requirements: Section 2.6 of the Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA states that alternatives are to be evaluated against the short- and long-term aspects of three broad criteria: 1) effectiveness; 2) availability; and 3) cost. Within each of these three criteria, a number of subcriteria are to be evaluated. Exhibit 3-2 presents a summary of the objectives/criteria and subcriteria that are to be used in the analysis of removal alternatives.

Groundwater Response Actions: Within M&E's October 28, 1994 Technical Memorandum, the groundwater alternatives were evaluated against a number of evaluation criteria/performance standards. Specifically, the evaluation criteria/performance standards included the following:

- Control the further migration of the contaminant plume in groundwater originating from the Granville Solvents site;
- Drinking water supply meets ARARs;
- Cleanup contaminant plume in groundwater originating from the Granville Solvents site to meet no-further-action levels;

EXHIBIT 3-2
OBJECTIVES/CRITERIA TO BE USED IN COMPARATIVE ANALYSIS OF ALTERNATIVES

- ❑ Effectiveness
  - ❑ Protectiveness
    - ❑ Protective of public health and community
    - ❑ Protective of workers during implementation
    - ❑ Protective of the environment
    - ❑ Complies with ARARs
  - ❑ Ability to Achieve Removal Objectives
    - ❑ Level of treatment/containment expected
    - ❑ No residual effect concerns
    - ❑ Will maintain control until long-term solution implemented
- ❑ Implementability
  - ❑ Technical Feasibility
    - ❑ Construction and operational considerations
    - ❑ Demonstrated performance/useful life
    - ❑ Adaptable to environmental conditions
    - ❑ Contributes to remedial performance
    - ❑ Can be implemented in 1 year
  - ❑ Availability
    - ❑ Equipment
    - ❑ Personnel and services
    - ❑ Outside laboratory testing capacity
    - ❑ Off-site treatment and disposal capacity
    - ❑ PRSC
  - ❑ Administrative Feasibility
    - ❑ Permits required
    - ❑ Easements or right-of-ways required
    - ❑ Impact on adjoining property
    - ❑ Ability to impose institutional controls
    - ❑ Likelihood of obtaining an exemption from statutory limits (if needed)
- ❑ Cost
  - ❑ Capital cost
  - ❑ PRSC cost
  - ❑ Present worth cost

Reference: USEPA Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA, Exhibit 7

- Treat soils to meet no-further-action levels;
- Implementability (technical feasibility and administrative feasibility);
- Federal and state acceptability; and
- Community acceptability.

These evaluation criteria do not coincide with the requirements set forth in the guidance documents. The NCP and CERCLA specify that remedies that are selected for implementation be cost-effective. As can be seen by comparison with Exhibit 3-2, the alternative costs were not even considered in the selection of a response alternative.

The effectiveness of the alternatives also was not considered as a criterion. One could speculate that the first four performance standards were supposed to represent the measure of the remedy's effectiveness; however, these performance standards are largely unsupported by the NCP process (as discussed in the preceding subsection). The use of these NCP-unsupported performance standards in the alternative selection process had the effect of eliminating specific alternatives that could not satisfy each of the criteria. In essence, the performance standards were developed in a manner that predetermined what approaches could be selected for implementation. For example, wellhead treatment at Village well PW-1 would be viewed negatively for failure to control further contaminant migration and for not treating soils to no-further-action levels despite the fact that this single action could eliminate all potential human health risks. The ability to evaluate the effectiveness of the removal alternative was severely hampered by the absence of a streamlined risk evaluation.

<u>Soil Response Actions</u>: The Design Technical Memorandum for the Remediation of Impacted Soils at the Granville site does not provide an evaluation of the soil remediation alternatives or a recommended soil remediation alternative. The document provides a soil data collection plan and notes that the data resulting from

the sample collection and analysis activities will be used to perform a further engineering design and cost analysis of the candidate treatment technologies.

3.3.1.5 Comparative Analysis of Removal Action Alternatives

Description: Section 2.7 of the Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA states that "Once the alternatives have been described and individually assessed against the criteria, a comparative analysis should be conducted to evaluate the relative performance of each alternative in relation to each of the criteria... The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another so that key tradeoffs that would affect the remedy selection can be identified." This is in contrast to M&E's analysis in which each alternative was analyzed independently without consideration of other alternatives.

Groundwater Response Actions: The Technical Memorandum (dated October 28, 1994) provides a very brief discussion of the five alternatives with regard to the evaluation criteria/performance standards; however, it provides virtually no comparative analysis between the various alternatives being considered. The failure to perform a comparative evaluation of the alternatives is not consistent with requirements of the NCP. Furthermore, as discussed in the preceding section, the evaluation criteria did not even consider costs or effectiveness of the alternatives.

Soil Response Actions: M&E has not performed a comparative analysis of soil alternatives.

3.4 M&E AND USEPA FAILED TO COMPLY WITH NCP REMEDIAL ACTION REQUIREMENTS

The agencies, M&E, and the parties to the AOC have been proceeding with response actions at the site. Appropriate justification for proceeding in accordance with removal action procedures has not been provided. In the absence of this justification, M&E should have proceeded in accordance with Sections 300.430 and 435 of the NCP. This section evaluates the work performed by M&E with respect to NCP Section 300.430 requirements for performance of a remedial investigation/feasibility study (RI/FS), since those activities would have been used to select actions to be implemented at the site. Exhibit 3-3 provides an overview of the RI/FS process. The exhibit is provided in USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, dated October 1988.

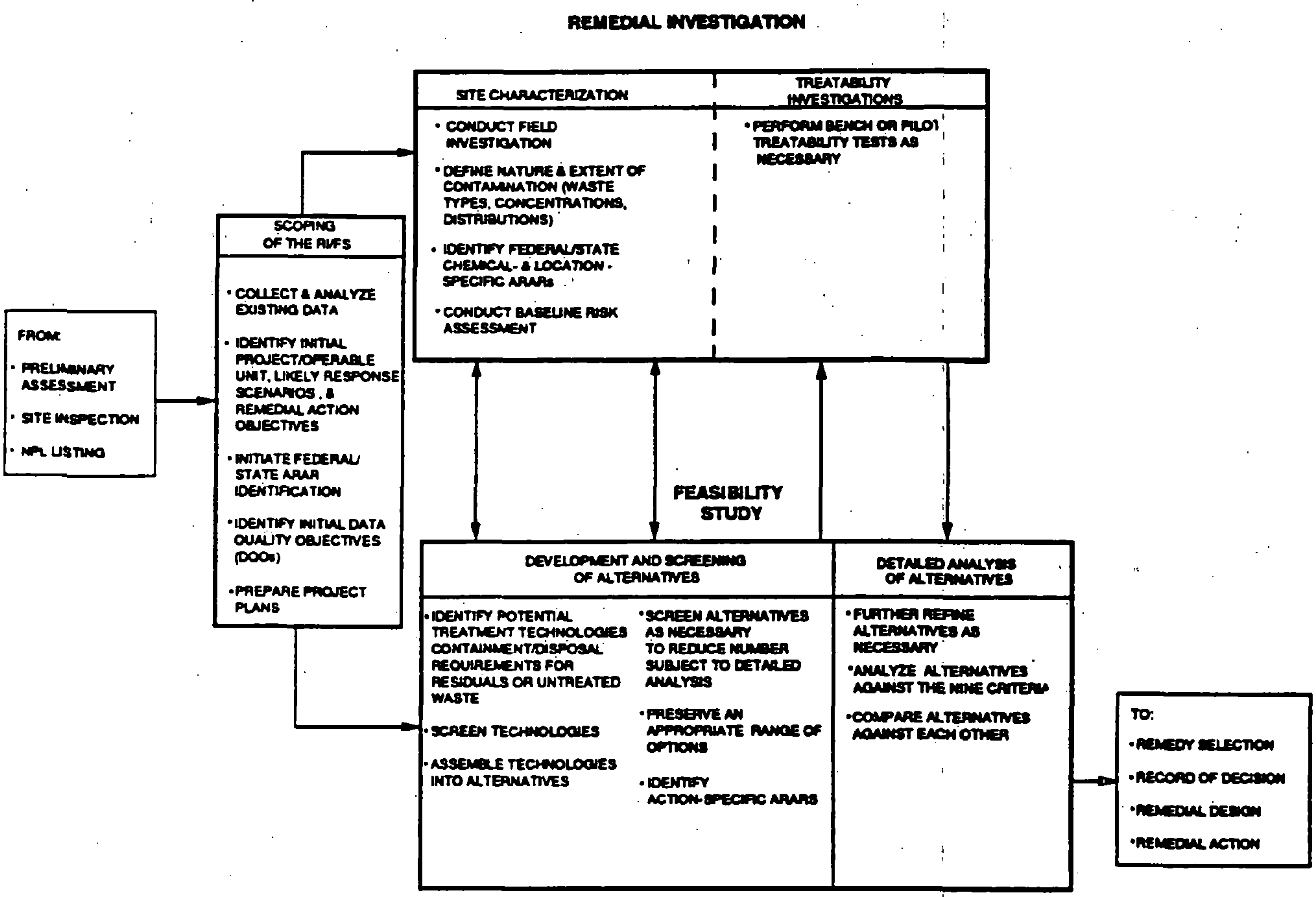
The RI/FS process includes preparation of well-organized deliverables for summarizing work activities performed. The kinds of items typically described in an RI report are shown on Exhibit 3-4. Section 5 of the RI report outline shows the key role of the contaminant fate and transport evaluation for the RI (and baseline risk assessment). The kinds of items that are detailed in an FS report are provided on Exhibit 3-5. These exhibits were also taken from the USEPA 1988 RI/FS Guidance document.

M&E did not prepare either an RI or FS report. M&E reports do not conform to the topics and items listed in the RI and FS report outlines.

3.4.1 Baseline Risk Assessment

The role of the human health evaluation in the Superfund remedial process is summarized on Exhibit 3-6. This exhibit is taken from USEPA's Risk Assessment

EXHIBIT 3-3
PHASED RI/FS PROCESS



Reference: *USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, October 1988, Figure 1-7.*

EXHIBIT 3-4
SUGGESTED RI REPORT FORMAT

Executive Summary

1. Introduction
    1.1 Purpose of Report
    1.2 Site Background
        1.2.1 Site Description
        1.2.2 Site History
        1.2.3 Previous Investigations
    1.3 Report Organization

2. Study Area Investigation
    2.1 Includes field activities associated with site characterization. These may include physical and chemical monitoring of some, but not necessarily all, of the following:
        2.1.1 Surface Features (topographic mapping, etc.) (natural and manmade features)
        2.1.2 Contaminant Source Investigations
        2.1.3 Meteorological Investigations
        2.1.4 Surface-Water and Sediment Investigations
        2.1.5 Geological Investigations
        2.1.6 Soil and Vadose Zone Investigations
        2.1.7 Ground-Water Investigations
        2.1.8 Human Population Surveys
        2.1.9 Ecological Investigations
    2.2 If technical memoranda documenting field activities were prepared, they may be included in an appendix and summarized in this report chapter.

3. Physical Characteristics of the Study Area
    3.1 Includes results of field activities to determine physical characteristics. These may include some, but not necessarily all, of the following:
        3.1.1 Surface Features
        3.1.2 Meteorology
        3.1.3 Surface-Water Hydrology
        3.1.4 Geology
        3.1.5 Soils
        3.1.6 Hydrogeology
        3.1.7 Demography and Land Use
        3.1.8 Ecology

4. Nature and Extent of Contamination
    4.1 Presents the results of site characterization, both natural chemical components and contaminants in some, but not necessarily all, of the following media:
        4.1.1 Sources (lagoons, sludges, tanks, etc.)
        4.1.2 Soils and Vadose Zone
        4.1.3 Ground Water
        4.1.4 Surface Water and Sediments
        4.1.5 Air

5. Contaminant Fate and Transport
    5.1 Potential Routes of Migration (i.e., air, ground water, etc.)
    5.2 Contaminant Persistence
        5.2.1 If they are appliable (i.e., for organic contaminants), describe estimated persistence in the study area environment and physical, chemical, and/or biological factors of importance for the media of interest.
    5.3 Contaminant Migration
        5.3.1 Discuss factors affecting contaminant migration for the media of importance (e.g., sorption onto soils, solubility in water, movement of ground water, etc.)
        5.3.2 Discuss modeling methods and results, if applicable.

6. Baseline Risk Assessment
    6.1 Human Health Evaluation
        6.1.1 Exposure Assessment
        6.1.2 Toxicity Assessment
        6.1.3 Risk Characterization
    6.2 Environmental Evaluation

Exhibit 3-4 (continued)

7. Summary and Conclusions
    - 7.1 Summary
        - 7.1.1 Nature and Extent of Contamination
        - 7.1.2 Fate and Transport
        - 7.1.3 Risk Assessment
    - 7.2 Conclusions
        - 7.2.1 Data Limitations and Recommendations for Future Work
        - 7.2.2 Recommended Remedial Action Objectives

Appendices

A. Technical Memoranda on Field Activities (if available)
B. Analytical Data and QA/QC Evaluation Results
C. Risk Assessment Methods

Reference: USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, October 1988, Table 3-13.

EXHIBIT 3-5
SUGGESTED FS REPORT FORMAT

Executive Summary

1. Introduction
    - 1.1 Purpose and Organization of Report
    - 1.2 Background Information (Summarized from RI Report)
        - 1.2.1 Site Description
        - 1.2.2 Site History
        - 1.2.3 Nature and Extent of Contamination
        - 1.2.4 Contaminant Fate and Transport
        - 1.2.5 Baseline Risk Assessment
2. Identification and Screening of Technologies
    - 2.1 Introduction
    - 2.2 Remedial Action Objectives –
      Presents the development of remedial action objectives for each medium of interest (i.e., ground water, soil, surface water, air, etc.). For each medium, the following should be discussed:
        - Contaminants of interest
        - Allowable exposure based on risk assessment (including ARARs)
        - Development of remediation goals
    - 2.3 General Response Actions –
      For each medium of interest, describes the estimation of areas or volumes to which treatment, containment, or exposure technologies may be applied.
    - 2.4 Identification and Screening of Technology Types and Process Options – For each medium of interest, describes:
        - 2.4.1 Identification and Screening of Technologies
        - 2.4.2 Evaluation of Technologies and Selection of Representative Technologies
3. Development and Screening of Alternatives
    - 3.1 Development of Alternatives –
      Describes rationale for combination of technologies/media into alternatives. Note: This discussion may be by medium or for the site as a whole.
    - 3.2 Screening of Alternatives (if conducted)
        - 3.2.1 Introduction
        - 3.2.2 Alternative 1
            - 3.2.2.1 Description
            - 3.2.2.2 Evaluation
        - 3.2.3 Alternative 2
            - 3.2.3.1 Description
            - 3.2.3.2 Evaluation
        - 3.2.4 Alternative 3
4. Detailed Analysis of Alternatives
    - 4.1 Introduction
    - 4.2 Individual Analysis of Alternatives
        - 4.2.1 Alternative 1
            - 4.2.1.1 Description
            - 4.2.1.2 Assessment
        - 4.2.2 Alternative 2
            - 4.2.2.1 Description
            - 4.2.2.2 Assessment
        - 4.2.3 Alternative 3
    - 4.3 Comparative Analysis

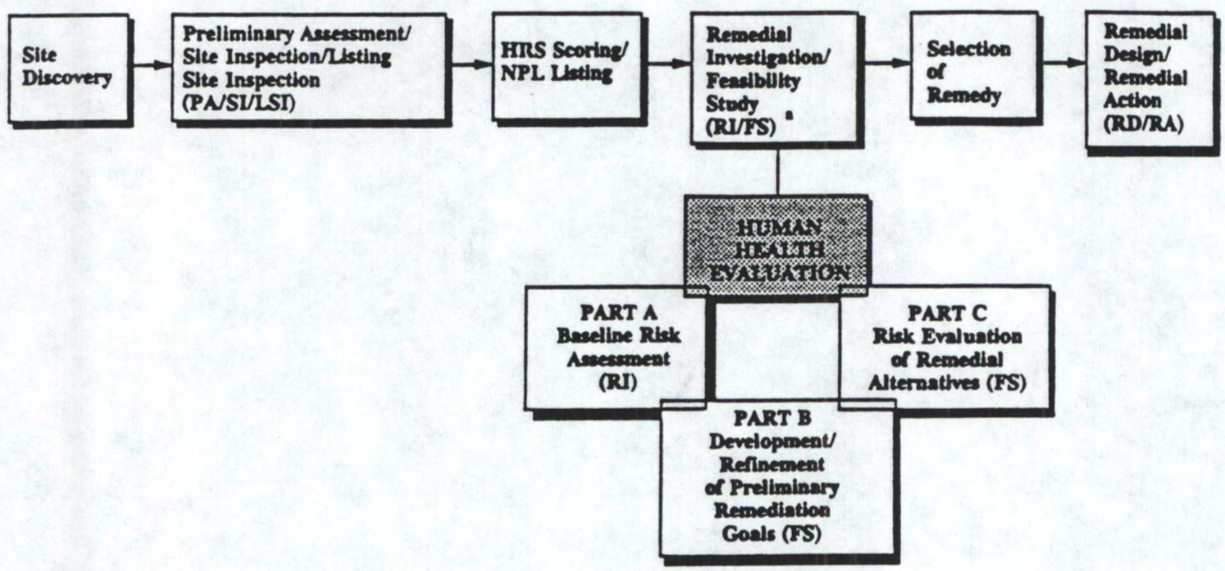
Bibliography

Appendices

Reference: USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, October 1988, Table 6-5.

EXHIBIT 3-6

ROLE OF THE HUMAN HEALTH EVALUATION IN THE SUPERFUND REMEDIAL PROCESS



[a] The RI/FS can be undertaken prior to NPL listing.

Reference: USEPA Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A), Interim Final, Exhibit 2-2.

Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A). As shown on the exhibit, it is an important part of the RI/FS activities.

The objective of a baseline risk assessment is to assess the magnitude and probability of harm to public health and the environment resulting from the release of hazardous substances from a site in the absence of remedial action (i.e., the no action alternative). The tasks typically performed in a baseline risk assessment include identification of the contaminants of concern, evaluating potential exposure pathways, assessing the toxicity of identified contaminants, and estimating the cancer and non-cancer risks. The following steps are generally performed in a baseline risk assessment:

- The contaminants of concern are compiled based on the sampling results of various media (water, soil, and air). During the data collection phase of the risk assessment, USEPA's Risk Assessment Guidance notes that activities should include, among others: addressing modeling parameter needs; collecting background data; conducting a preliminary exposure assessment; devising an overall strategy for sample collection; and examining QA/QC measures. For the data evaluation phase of the risk assessment, USEPA Risk Assessment Guidance states that activities should include, among others: combining data available from site investigations; evaluating analytical methods; evaluating quantification limits; evaluating blanks; comparing site data with background; and identifying chemicals of potential concern.

- Then an exposure assessment is conducted that includes characterizing the exposure setting, identifying potentially exposed populations and exposure pathways, and quantifying the exposure (chemical intakes). Typically, the chemical intakes are assessed through modeling to predict concentrations at receptor points for use in the exposure assessment.

- Toxicity information for non-carcinogenic and carcinogenic effects are compiled from approved and current databases (such as the Integrated Risk Information System, IRIS).

- Then the carcinogenic and non-carcinogenic risks to humans are quantified using the appropriate cancer slope factors and reference dose rates for non-carcinogenics. This activity typically includes quantifying risks from multiple chemicals and combining risks across exposure pathways.

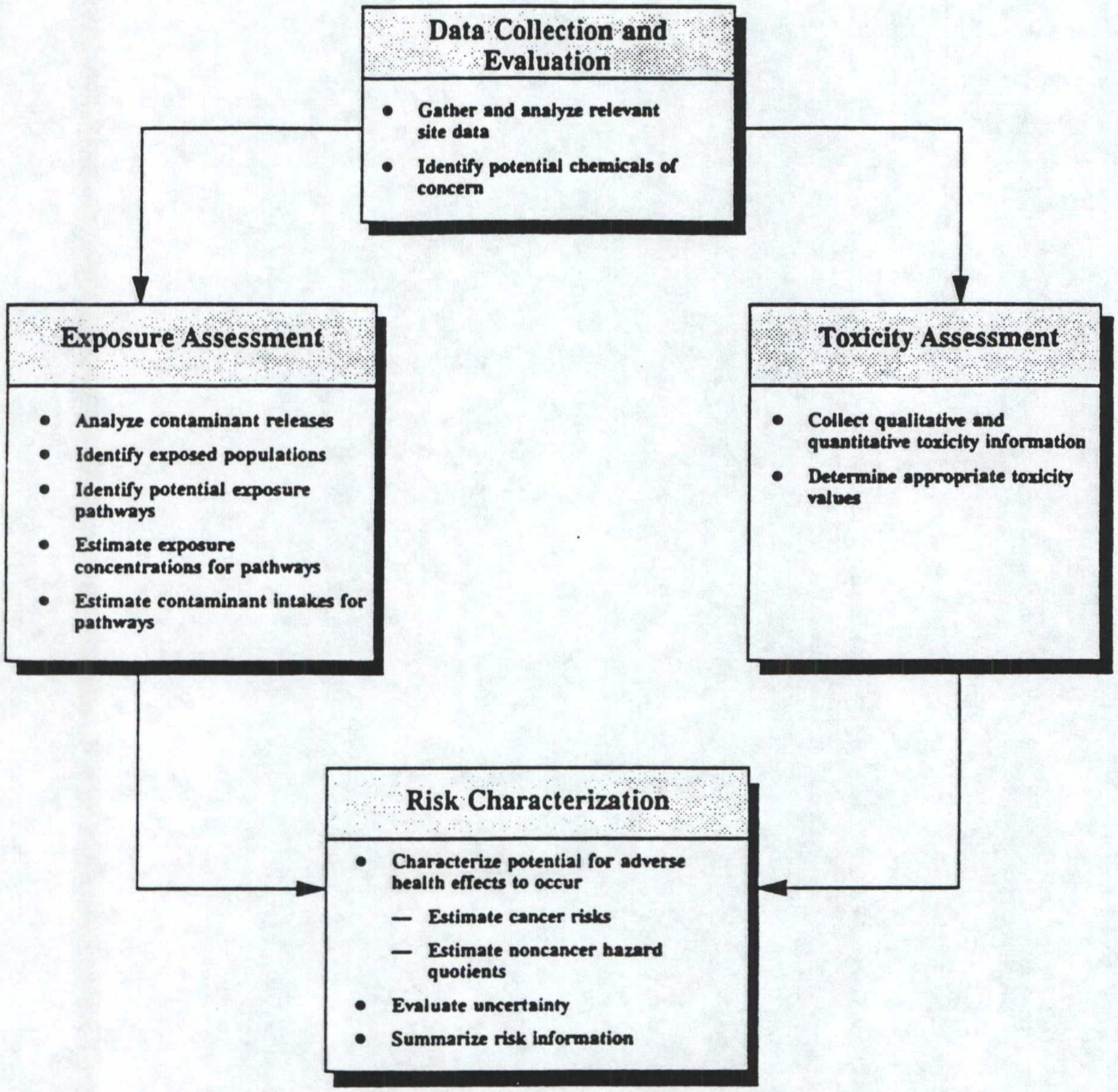
An overview of this risk assessment process is provided as Exhibit 3-7.

3.4.1.1 Requirements

The introduction to the NCP states that "the purpose of the remedy selection process is to implement remedies that eliminate, reduce or control risks to human health and the environment." 40 CFR Part 300.430(d)(4) states that "the lead agency shall conduct a site-specific baseline risk assessment to characterize the current and potential threats to human health and the environment that may be posed by contaminants migrating to ground water or surface water, releasing to air, leaching through soil, remaining in the soil, and bioaccumulating in the food chain. The results of the baseline risk assessment will help establish acceptable exposure levels for use in developing remedial alternatives in the FS."

The critical role that the risk assessment plays in the FS process is demonstrated by Section 300.430(e)(2), which requires that "Alternatives shall be developed that protect human health and the environment by recycling waste or by eliminating, reducing, and/or controlling risks posed through each pathway by a site." Final remediation goals, which are determined when the remedy is selected, are required by Section

EXHIBIT 3-7
BASELINE RISK ASSESSMENT



Reference: USEPA Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A), Interim Final, Exhibit 1-2.

300.430(e)(2)(i) to "establish acceptable exposure levels that are protective of human health and the environment...".

NCP Section 300.430(e)(2)(i) also states that "for systemic toxicants, acceptable exposure levels shall represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety;" and "for known and suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response."

These citations indicate the importance of performing a risk assessment in the remedial action process.

3.4.1.2 Groundwater Response Actions

Performing a risk assessment is the recognized method for establishing public health or environmental risks. It is the method by which it is determined if a site poses excess lifetime cancer risks that exceed the 10^{-4} to 10^{-6} range, or if the non-cancer hazard index exceeds one. These are normal ranges of risks that are concluded to require response actions at CERCLA sites. The failure to perform a risk assessment prevented the identification of whether any remedial actions were required, development of remedial action objectives, development of a proper array of alternatives, and performance of a meaningful evaluation of the effectiveness of response actions at reducing risk to human health. As a result, groundwater alternatives could not be properly developed or evaluated.

3.4.1.3 Soil Response Actions

The discussion above relating to risk evaluation for groundwater response is also applicable to soil response in the remedial action context. The deficiencies in 3.4.1.2 relating to groundwater response actions are also applicable to soil response actions.

3.4.2 Remedial Action Objectives

3.4.2.1 Requirements

Remedial Action Objectives (RAOs) are the goals established for Superfund site remedies to protect human health and the environment. The establishment of RAOs is the first step of the remedial alternative development process, and RAOs are used throughout the remedy selection process to evaluate and compare alternatives. The use of appropriate RAOs is crucial to the development, evaluation, and selection of a preferred alternative to address site concerns.

The NCP requires that USEPA "establish remedial action objectives specifying contaminants and media of concern, potential exposure pathways, and remediation goals." This section also states "final remediation goals will be determined when the remedy is selected. Remediation goals shall establish acceptable exposure levels that are protective of human health and the environment..."

The USEPA Guidance for Conducting RI/FS Under CERCLA states:

> Remedial action objectives aimed at protecting human health and the environment should specify:
>
> - The contaminant(s) of concern

- Exposure route(s) and receptor(s)
- An acceptable contaminant level or range of levels for each exposure route (i.e., a preliminary remediation goal)

The USEPA guidance document goes on to specify that remedies should be evaluated with respect to their ability to provide an acceptable level of risk, achieve chemical-specific regulatory levels, address environmental effects, and adequately address "each significant pathway of human exposure identified in the baseline risk assessment."

3.4.2.2 Groundwater Response Actions

No RAOs were developed for the Granville Solvents site. Instead, performance standards were presented in Section 4.0 of the Work Plan as a substitute for the RAOs for the groundwater cleanup efforts. These performance standards were established based on requirements of the AOC, which were themselves not consistent with the NCP. Additionally, the failure to perform the baseline risk assessment prevented the development of meaningful RAOs to guide and direct site remediation efforts.

The October 28, 1994 Revision 2 of Technical Memorandum and July 24, 1995 Work Plan stated that the performance standards of the groundwater extraction and treatment system were: (1) to prevent further migration of groundwater contamination (originating from the site) toward the Village of Granville municipal wellfield; and (2) to treat and discharge all extracted water as required by the Work Plan and the AOC.

M&E's performance standards failed to specify the contaminants of concern, and the acceptable contaminant level or range of levels for each exposure route. Instead, they simply state that they will prevent migration of groundwater contamination, without regard to whether any risks were being mitigated. As stated earlier, VOCs have not been detected in PW-1, and groundwater quality at MW-8 also met drinking water standards.

3.4.2.3 Soil Response Actions

The Design Technical Memorandum for the Remediation of Impacted Soils provides a limited risk evaluation which purports to support the development of removal action goals and objectives; however, the use of the soil to groundwater migration pathway and assumption that groundwater is consumed at the site again results in development of overly broad remedial action objectives/preliminary remediation goals.

3.4.3 Alternative Development

3.4.3.1 Requirements

USEPA's Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA presents the requirements for alternative development. The process is a four-step method that follows identification of RAOs. The steps are: 1) development of general response actions; 2) identification and screening of remedial technologies; 3) assembly of alternatives; and 4) alternative screening. The objective of this process is to develop appropriate ranges of options that will be analyzed more fully through detailed alternative evaluations.

3.4.3.2 Groundwater Response Actions

The Technical Memorandum (dated October 28, 1994) provided a summary of alternatives that were considered for the groundwater extraction and treatment system. The alternatives included groundwater sparging coupled with soil-vapor extraction; source area groundwater pump and treat; groundwater sparging, soil-vapor extraction coupled with groundwater pump and treat; wellhead treatment at Village Well PW-1; and source area groundwater pump and treat in conjunction with wellhead treatment at Village Well PW-1.

Contrary to the NCP, the documents addressing the groundwater response action did not identify and carry the no action alternative through the alternative evaluation and comparison process. Additionally, although guidance indicates that only a few alternatives need to be identified, the alternatives identified clearly indicate that the response action was pre-determined. There were several variations of pumping and treatment schemes that should have been considered in addition to the scheme eventually implemented.

3.4.3.3 Soil Response Actions

The Design Technical Memorandum for the Remediation of Impacted Soils at the Granville site dated December 8, 1995, identified a number of remedies. No remedy has been selected. The alternatives do not include "no action" as an alternative for consideration.

3.4.4 Detailed Analysis of Alternatives

3.4.4.1 Requirements

NCP Section 300.430(e) and (f) note that nine criteria should be used to screen and analyze alternatives during an FS and during remedy selection. The nine criteria categorized into the following three groups:

- Threshold Criteria: Two threshold criteria must be satisfied for an alternative to be eligible for selection: 1) Overall Protection of Human Health and the Environment; and 2) Compliance with ARARs.

- Primary Balancing Criteria: Five balancing criteria are used in the alternative evaluation, that tend to drive the alternative selection process: 1) Long Term Effectiveness and Permanence; 2) Reduction of Toxicity, Mobility or Volume Through Treatment; 3) Short Term Effectiveness; 4) Implementability; and 5) Cost.

- Modifying Criteria: Two modifying criteria are considered during the remedy selection: State Acceptance and Community Acceptance.

Exhibit 3-8 presents an overview of the kinds of items that go into evaluating the alternatives for each criterion. The exhibit is taken from USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.

3.4.4.2 Groundwater Response Actions

M&E failed to use the nine NCP criteria to evaluate the remedies and support remedy selection. The Technical Memorandum for the Removal Action at the Granville site (dated October 28, 1994) provided a summary of alternatives that were considered for the groundwater extraction and treatment system. These alternatives were evaluated against a number of evaluation criteria/performance standards. Specifically, the evaluation criteria/performance standards included the following:

- Control the further migration of the contaminant plume in groundwater originating from the Granville Solvents site;
- Drinking water supply meets ARARs;

EXHIBIT 3-8
CRITERIA FOR DETAILED ANALYSIS OF ALTERNATIVES

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

- How Alternative Provides Human Health and Environmental Protection

COMPLIANCE WITH ARARs

- Compliance With Chemical-Specific ARARs
- Compliance With Action-Specific ARARs
- Compliance With Location-Specific ARARs
- Compliance With Other Criteria, Advisories, and Guidances

LONG-TERM EFFECTIVENESS AND PERMANENCE

- Magnitude of Residual Risk
- Adequacy and Reliability of Controls

REDUCTION OF TOXICITY MOBILITY, AND VOLUME THROUGH TREATMENT

- Treatment Process Used and Materials Treated
- Amount of Hazardous Materials Destroyed or Treated
- Degree of Expected Reductions in Toxicity, Mobility, and Volume
- Degree to Which Treatment Is Irreversible
- Type and Quantity of Residuals Remaining After Treatment

SHORT-TERM EFFECTIVENESS

- Protection of Community During Remedial Actions
- Protection of Workers During Remedial Actions
- Environmental Impacts
- Time Until Remedial Action Objectives Are Achieved

IMPLEMENTABILITY

- Ability to Construct and Operate the Technology
- Reliability of the Technology
- Ease of Undertaking Additional Remedial Actions, if Necessary
- Ability to Monitor Effectiveness of Remedy
- Ability to Obtain Approvals From Other Agencies
- Coordination With Other Agencies
- Availability of Offsite Treatment, Storage, and Disposal Services and Capacity
- Availability of Necessary Equipment and Specialists
- Availability of Prospective Technologies

COST

- Capital Costs
- Operating and Maintenance Costs
- Present Worth Cost

STATE [1] ACCEPTANCE

COMMUNITY [1] ACCEPTANCE

[1] These criteria are assessed following comment on the RI/FS report and the proposed plan.

Reference: USEPA Risk Assessment Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, October 1988, Figure 6-2.

- Cleanup contaminant plume in groundwater originating from the Granville Solvents site to meet no-further-action levels;
- Treat soils to meet no-further-action levels;
- Implementability (technical feasibility and administrative feasibility);
- Federal and state acceptability; and
- Community acceptability.

These evaluation criteria do not coincide with the requirements set forth in the NCP and guidance documents. One of the Threshold criteria (Overall Protection of Human Health and the Environment) and four of the Primary Balancing Criteria (Long-Term Effectiveness and Permanence; Reduction of Toxicity, Mobility, or Volume through Treatment; Short-Term Effectiveness; and Cost) were not included as criteria for remedy evaluation and selection.

The use of these NCP-unsupported performance standards in the alternative selection process had the effect of eliminating specific alternatives that could not satisfy each of the criteria. In essence, the performance standards were developed in a manner that predetermined what approaches could be selected for implementation. For example, wellhead treatment at Village well PW-1 would be viewed negatively for failure to control further contaminant migration and for not treating soils to no-further-action levels despite the fact that this action may have eliminated all potential human health risks.

M&E also performed a remedy evaluation without the benefit of a risk assessment. The risk assessment is an essential tool for use in the decision making process to provide information for evaluating the overall protectiveness of human health and the environment and long term effectiveness and permanence. Additionally, the failure to conduct a risk assessment prevented evaluation of the no-action alternative, which is essential for determining the need for any remedial actions.

3.4.4.3 Soil Response Actions

The Design Technical Memorandum for the Remediation of Impacted Soils at the Granville site does not provide a recommended soil remediation alternative. The document goes on to provide a soil data collection plan. The document notes that the data resulting from the sample collection and analysis activities will be used to perform a further engineering design and cost analysis of the candidate treatment technologies. CEC understands that no soil remedial action alternative has been selected by M&E at the present time.

3.4.5 Remedy Selection Criteria - Need for Cost Consideration

3.4.5.1 Requirements

To prevent simply achieving protectiveness through use of excessive or unnecessary remedial measures, NCP Section 300.430(f)(1)(ii)(D) requires that "each remedial action selected shall be cost-effective, provided that it first satisfies the threshold criteria ... Cost-effectiveness is determined by evaluating the following three of the five balancing criteria ... to determine overall effectiveness: long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, and short term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective. A remedy shall be cost effective if its costs are proportional to its overall effectiveness."

3.4.5.2 Groundwater Response Actions

As discussed earlier, M&E failed to consider cost in any manner in their decision documents and comparative analyses of remedial alternatives for the groundwater issues. CERCLA and the NCP also demand that remedies that are selected for implementation be cost-effective. The alternative costs were not even considered in the selection of the remedial alternative. As discussed earlier, it does not appear that effectiveness of the alternatives could be evaluated due to the lack of a risk assessment and use of unsupported RAOs. Without consideration of the alternatives' costs or effectiveness, M&E could not have evaluated or compared the alternatives to select a "cost-effective" remedy.

3.4.5.3 Soil Response Actions

CEC understands that no removal action/remedial action alternative has been selected by M&E at the present time.

4.0 REFERENCES

40 Code of Federal Regulations (CFR), Part 300, National Hazardous Substances and Pollution Contingency Plan (NCP).

Clean Harbors, Ohio Environmental Protection Agency, Division of Emergency & Remedial Response, Final Report, Mobilization Order 145-01, Granville Solvents, Inc., Summary of Events, Section 1.0.

Compliance Solutions, Inc., Ohio Environmental Protection Agency Mobilization Order #145-02, Granville Solvents Interim Action, Final Report, August 26, 1992.

Compliance Solutions, Inc., Waste & Chemical Management Strategies, January 13, 1993. Granville Solvents Interim Action, Ohio EPA Mobilization Order #145-03, Final Report.

Domerco, P.A. & G. A. Robbins, 1985. A New Method of Contaminant Plume Analysis: Groundwater, v. 23, no. 4, pp. 476-485.

Konikow, L.F. & J. D. Bredehoeft, 1978. Computer Model of Two-Dimensional Solute Transport & Dispension in Groundwater: U.S. Geological Survey Tech of Water Resc Inves., Book 7, Ch 2.

Metcalf & Eddy, April 28, 1994. Amended Interim Response Action Plans, Draft Work Plan, Revision 2.

Metcalf & Eddy, October 28, 1994. Technical Memorandum for the Removal Action at the Granville Solvents Site.

Metcalf & Eddy, January 31, 1995. Removal Action Aquifer Pumping Test Report for the Granville Solvents Site.

Metcalf & Eddy, July 6, 1995. Design Technical Memorandum, Remediation of Impacted Soils, Granville Solvents Site.

Metcalf & Eddy, July 6, 1995. Technical Evaluation of Alternatives to Reinstate the Capacity of the Village of Granville Water Supply Well, PW-1.

Metcalf & Eddy, July 19, 1995. Treatability Performance Report of the Groundwater Treatment System.

Metcalf & Eddy, July 24, 1995. Revised Work Plan for the Removal Action at the Granville Solvents Site.

Metcalf & Eddy, July 25, 1995. Revised Removal Action Groundwater Monitoring Program Plan, Granville Solvents Site.

Metcalf & Eddy, August 31, 1995. Design Technical Memorandum for the Remediation of Impacted Soils at the Granville Solvents Site.

Metcalf & Eddy, December 8, 1995. Design Technical Memorandum for the Remediation of Impacted Soils at the Granville Solvents Site, Granville, Ohio Submitted to The United States Environmental Protection Agency.

Ohio EPA Division of Solid & Hazardous Waste Management, Central District Office, August 30, 1985. Preliminary Assessment Narrative.

Ohio EPA Letter (author not identified; only first page of letter is available) to Doug Plunket (Granville Village Manager) dated June 3, 1993.

Plunkett, Douglass E. (Granville Village Manager) Letter to Donald Shregardus (Director, Ohio EPA) dated April 9, 1993.

Soller, D.R., 1986. Preliminary Map Showing the Thickness of Glacial Deposits in Ohio: U.S. Geological Survey Misc. Field Studies Map MF-1861. 1 sheet.

U. S. Environmental Protection Agency, EPA/540/G-89/004, OSWER Directive 9355.3-01, October 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final.

U. S. Environmental Protection Agency, EPA/540/1-89/002, December 1989. Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A), Interim Final.

U. S. Environmental Protection Agency, Directive 9345.1-16FS, Integrating Removal and Remedial Site Assessment Investigations

U. S. Environmental Protection Agency, July 7, 1992, OSWER Directive No. 9203.1-03, Guidance on Implementation of the Superfund Accelerated Cleanup Model (SACM) Under CERCLA and the NCP.

U. S. Environmental Protection Agency, August 1993, Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA.

U. S. Environmental Protection Agency, November 29, 1993. Screening Site Inspection Site Evaluation, Granville Solvents, Inc., USEPA ID No. OHD 004 495 412.

U.S. Environmental Protection Agency, September 7, 1994. Administrative Order by Consent Issued for Granville Solvents Site Pursuant to Sections 106 and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as Amended.

APPENDIX A

RESUMES OF KEY CEC PERSONNEL

RESUME

DEBORA B. THOMPSON

EDUCATION

M.S., Geological Sciences, University of Wisconsin - Milwaukee
B.S., Geological Science, The Pennsylvania State University

PROFESSIONAL REGISTRATION

Licensed Geologist, North Carolina, #924
Certified Groundwater Professional #318
Licensed Professional Geologist, South Carolina #1113

EXPERIENCE

Ms. Thompson, a Senior Project Manager and Hydrogeologist, has been active in environmental and groundwater projects since 1981. She has experience in performance and management of hazardous-waste site investigations, environmental audits and assessments, groundwater computer modeling, aquifer delineation, design and installation of monitoring-well networks and pumping wells, assessment of groundwater flow and contaminant transport in complex geologic environments, assessment of environmental contamination in various media, and compliance with federal and state environmental regulations. She has been responsible for complete site investigations, remedial design, permitting, and remediation projects for sites with contaminated soil, groundwater, and surface water. She also has extensive experience in regulatory negotiations and compliance.

Environmental Site Investigations

Currently managing remediation of a former metal-plating facility in South Carolina under consent order. Extensive groundwater contamination on-site and off-site has resulted from a pre-RCRA impoundment, and groundwater discharge has resulted in contaminated surface water and sediment. Investigations have been conducted to evaluate the extent of groundwater contamination at multiple depths within the aquifer. Surface-water investigations have evaluated the magnitude and extent of contamination, as well as quantifying the relationship between groundwater and surface water. Investigations have involved a high level of regulatory involvement. Ms. Thompson managed the effort to select a remedial alternative which has been approved by the state and is currently in final design.

Currently managing activities at a light-manufacturing facility in Mississippi. Investigations conducted to evaluate previous remediation of a former landfill area indicated that the bulk of the contaminants had been removed, and impacts on groundwater have been negligible with respect to both volatile organic compounds and metals. Investigations of a former impoundment area have shown heavy stratification of contaminants in the groundwater system, migration of the contaminant plume off site, multiple contaminant source areas, and contaminated stream bed materials. Source areas were identifiable by chemical fingerprints, previously unidentified waste-disposal areas were identified from historic aerial photographs, and assessment of old facility plans. The site is currently being remediated by excavation of contaminated sediments and augmentation of an existing pump and treat system.

Investigated groundwater contamination under Administrative Order at an industrial facility located on a limestone terrain. Analytical groundwater modeling was employed to evaluate risks due to contaminant migration in groundwater and showed that risks were negligible if soil contamination were mitigated. CEC negotiated with regulators and obtained approval for remediation of soils by vapor extraction and "no-action" on groundwater. Groundwater monitoring is on-going.

Performed Phase I and II Soil and Groundwater Cleanup Programs at a printing facility under consent order with the Pennsylvania Department of Environmental Resources. Investigations included hydropunch borings, well installation, and aquifer testing. Extremely low hydraulic conductivities hindered site remediation. Currently evaluating sparging and biodegradation as remedial technologies.

Managed remedial investigation and site remediation at a small electronics manufacturer. Investigations included well installation, a long-term pump test, and groundwater computer modeling. Soil borings were installed on a 50-foot grid, and samples were analyzed on overnight turnaround to allow modifications to the drilling program for accurate delineation of contaminated areas. Investigations identified soil and groundwater contamination caused by burning and bulk dumping of solvents, and a drum-burial area.

Managed groundwater investigations conducted at a Superfund site to support an amendment to the EPA Record of Decision (ROD). CEC's evaluation of the groundwater remedy specified in the ROD indicated that the remedy would be ineffective in mitigating groundwater contamination and may even exacerbate the problem. A 96-hour pump test was conducted in conjunction with a tracer test to prove close hydraulic communication between a sandstone aquifer and the underlying mine voids. Results proved that the vast majority of the water pumped from a well completed in the sandstone had its source in the mine void and that the capture zone for a well completed in the sandstone was extremely limited.

Project manager for a Groundwater Assessment and Abatement program at an 800-acre scrubber-sludge impoundment in the Allegheny Plateau. Groundwater contamination was identified in multiple aquifers, and surface-water quality in an adjoining watershed was affected. Assessment of water quality was complicated by pre-existing brine contamination, and trilinear diagrams were used to discriminate among contaminant types.

Evaluated soil and groundwater contamination at a former steel manufacturer. Cyanide contamination was assessed using several analytical methodologies to determine the proportion of free cyanide.

Participated in remediation of solvent-contaminated soils at a "midnight dumping" site in Kentucky. Site included three areas of highly contaminated soils, buried drums, and several contaminated domestic wells. Site remediation was completed on a rapid turnaround to meet regulatory deadlines.

Managed a Groundwater Assessment Program at a chemical repackaging facility. Investigations included installation of monitoring wells, aquifer testing, and contaminant-transport modeling. Multiple source areas with differing chemical characteristics were identified.

Performed Phase I and II environmental assessments at a wood-treating facility. Identified and assessed soil contamination caused by runoff from freshly treated lumber and assessed contamination of surface water and sediment resulting from storm events.

Performed preacquisition environmental assessments at a number of active and inactive facilities with histories of industrial, mining, or commercial use, including a former hazardous-waste trucking operation, coal-mine support facilities, an electronics manufacturer, warehouses, a coke operation, metal-plating operations, an aluminum smelter, and automotive retailers.

Assessed the fate of transformer oil released to the environment when a 50,000-gallon substation transformer ruptured. Through field reconnaissance, it was determined that a previous consultant's conclusion that groundwater was badly contaminated was based on data from improperly constructed wells. Soil sampling showed that the bulk of the oils were bound in shallow soils, where they would biodegrade without ill effects.

Managed the assessment of the extent of PCB contamination in soils at a former transformer-salvage operation in western Pennsylvania. Mobile-laboratory analysis allowed quick receipt of analytical results so the drilling program could be modified on a daily basis. Three-dimensional assessment of concentrations allowed planning of remedial excavation.

Regulatory Compliance

Managed RCRA and state quarterly monitoring programs for a number of sites, including steel manufacturers, electronics facilities, residual-waste facilities, electric-generating utilities, chemical facilities, and hazardous-waste facilities. Programs included monitoring for organic and inorganic contaminants, as well as tracking, assessment, statistical analysis, and reporting of data.

Prepared Groundwater Monitoring Plans for a number of RCRA and non-RCRA facilities. Prepared Groundwater Assessment Plans for facilities under federal and state regulations.

Prepared a RCRA sampling plan and delisting petition for sludges generated by a leachate-treatment plant at a closed hazardous-waste impoundment.

Performed a Groundwater Assessment Program for a hazardous-waste impoundment at a steel-manufacturing facility. Investigations included assessment of existing groundwater-monitoring data, supplemented by sampling of numerous seeps around the facility. Computer modeling was used to evaluate the effects of closure on groundwater contamination.

Managed permitting of water and air discharges for treatment facilities associated with groundwater-remediation systems.

Prepared a groundwater assessment and closure evaluation of a process-water impoundment at a specialty-steel manufacturer. Assessment included statistical analysis of groundwater chemical data and comparison of downgradient water quality to multiple background points. Closure evaluation included statistical comparison of confirmational soil samples to industrially affected background soil samples.

Participated in Superfund investigations of sites in Pennsylvania, Louisiana, Ohio, Massachusetts, New Jersey, and Vermont.

Involved in repermitting of a scrubber-sludge impoundment under Residual Waste Regulations.

Remedial Design and Site Remediation

Managed remediation of a solvent-contaminated site. Drums and contaminated soils were excavated and incinerated. Multiple waste types and mixed wastes were included in the project. Designed a groundwater-extraction system for solvent-contaminated groundwater in an alluvial aquifer using a digital solute-transport model to evaluate the effects of various well configurations on the groundwater system. Oversaw construction and optimization of the extraction and treatment systems.

Managed conceptual design of a groundwater-extraction system at a chemical facility with multiple source areas. The designed well network was configured to take maximum advantage of the natural groundwater flow patterns.

Designed soil and groundwater remediation for toluene contamination at a printing facility.

Designed a groundwater-extraction system to remediate acid-contaminated groundwater at a steel manufacturer. Space for construction of the facility was limited, and accessibility had to be considered in the design. At the client's request, the system was designed for containment rather than aggressive plume removal.

Currently involved in design of a groundwater remediation system for a solvent-contaminated site with extensive off-site migration of contaminants. The contaminant plume extends over 1,500 feet beyond the property boundary. System design takes advantage of flow patterns in this topographically and geologically complex environment.

Supervised soil remediation at several sites with contamination resulting from underground and above-ground storage tanks.

Managed remediation efforts for a PCE-contaminated site with contaminated stream sediments and probable free-product in the groundwater system.

Groundwater Modeling and Computer Applications

Managed development of a digital computer model to evaluate groundwater flow and contaminant transport in a thick saprolite overlying metamorphic bedrock. The model was used to project contaminant transport and design a groundwater-remediation system.

Wrote a custom database package for management of quarterly groundwater analyses collected for RCRA. The program included routines to report data, perform statistical analyses with corrections for non-detect values, and plot changes in water quality through time.

Performed three-dimensional digital modeling of groundwater flow at a landfill in the Coastal Plain to evaluate the impacts of potential remedial alternatives. Evaluated the effects of capping, slurry walls, groundwater extraction, and combined alternatives.

Developed a two-dimensional groundwater flow and contaminant-transport model to design a system of pumping wells to remediate a plume of acid-contaminated groundwater.

Used digital computer modeling to simulate groundwater flow and contaminant transport at a solvent-contaminated site with multiple contaminant sources. Evaluated source terms to select soil cleanup levels.

Mining-Related Projects

Managed a project to assess the effects of longwall mining on domestic well yields over a coal mine in southeastern Ohio. The assessment included short-term and long-term pumping tests, as well as a comparison of results to publicly available regional data.

Supported a coal company in its defense against claims that their longwall mining operation had resulted in diminution of groundwater quality and quantity in local private wells. Activities included assessment sampling domestic wells, comparing groundwater quality to background wells, and evaluating the relationship between well depth, location, and water quality.

Investigated groundwater contamination caused by lead-zinc mining of a pegmatitic limestone at a Superfund site in Kansas.

Performed investigations to evaluate the magnitude of hydraulic interaction between an abandoned coal mine and pumping wells completed in the overlying sandstone at a Superfund site in western Pennsylvania. Activities included a long-term pump test, tracer test, and evaluation of well hydraulics.

Water-Resource Evaluation

Planned and executed testing of a municipal water-supply well in western Pennsylvania.

Managed a project to evaluate the potential for a large gasoline spill to impact nearby municipal groundwater supplies in the Ohio Valley.

Designed and tested wells to provide water supply for mine-support facilities in West Virginia. Fracture-trace analysis was used in locating the wells.

Managed a project to evaluate the impact of longwall coal mining on groundwater resources in southeastern Ohio.

Performed investigations to assess the hydraulic interaction between the Niagaran Dolomite aquifer and Lake Michigan in Wisconsin.

PROFESSIONAL AFFILIATIONS

National Groundwater Association

PUBLICATIONS

"A Micro-Computer Program for the Interpretation of Time-Lag Permeability Tests," Groundwater, March 1987.

"Hydrogeology of the Niagara Dolomite Aquifer at Wind Point, Wisconsin, and Its Interaction with Lake Michigan," Masters Thesis, University of Wisconsin - Milwaukee, 1981.

RESUME

JAMES E. MUDGE, Ph.D.

EDUCATION

Ph.D., Physiology/Biology, Pennsylvania State University
M.S., Physiology/Biology, Pennsylvania State University
M.Ed., Biological Sciences, Pennsylvania State University
B.S., Biology/Chemistry, Mansfield State College

EXPERIENCE

Dr. Mudge, Principal Environmental Scientist for CEC, has over twenty years of environmental monitoring, impact assessment, and risk assessment experience working both for electric utilities and environmental consulting firms. He has an extensive background in the life and natural sciences and directs projects that utilize his expertise in environmental impact evaluations (e.g. ESA, EIS), human health and ecological risk assessments, environmental and water quality monitoring, wetlands and permitting. He has managed a staff of scientists and engineers in performance of activities related to remedial investigations and site characterizations, risk assessments, and hazardous materials/waste management programs. Dr. Mudge has supervised or performed over 100 environmental assessments of commercial, industrial, and municipal properties. The assessments were designed to identify potential public and/or environmental risks and liabilities which exist on sites that were either being sold or acquired. Phase one environmental site assessments (ESAs) often expanded, as a result of site conditions, into defining the extent of contaminants in soil, ground water, surface water, sediments and other potential receptors.

Assessment areas have included above ground and underground storage tanks, hazardous materials, and wetlands. Wetland assessments have included the delineation of wetlands using office and field techniques in accordance with federal and state protocols. Toxic and hazardous substance assessments have included petroleum products, herbicides, pesticides, heavy metals, polychlorinated biphenyls, solvents, asbestos, radon, and radiological parameters. Conditions and pathways for contaminant migration were defined with due consideration given to source and receptors in making recommendations for remedial action.

Dr. Mudge previously directed the technical and administrative aspects of eastern U.S. operations for Beak Consultants Incorporated. He managed a staff in performance of monitoring programs in Lakes Ontario and Erie. In addition, he was the project manager for hydrogeologic investigations of landfills in western New York and water quality and biomonitoring projects for numerous clients.

As a staff scientist for Rockwell International, Dr. Mudge was responsible for environmental licensing and monitoring as related to siting, constructing, and operating a nuclear waste repository. Activities included identification of applicable federal, state, and local regulations, obtaining necessary permits, and ensuring required monitoring and surveillance was performed.

As principal scientist for the Washington Public Power Supply System, Dr. Mudge was program leader for ecological and radiological monitoring programs and supervised six individuals in performance of these programs. He designed and implemented acute and chronic bioassays to assess the toxicity of copper and zinc chemical forms to salmonids. He managed the radiological environmental monitoring program which included the collection and radiochemical analysis of different media (e.g. air, water, soil, milk, fish, vegetables) in order to derive subsequent dose and risk assessment estimates.

Dr. Mudge was actively involved in licensing Washington Public Power Supply System's Nuclear Unit 2. His responsibilities included preparation of license application (e.g. NPDES permits) and programs responsive to regulatory requirements (i.e. CERCLA, TSCA, RCRA).

Dr. Mudge served as senior environmental scientist for the Washington Public Power Supply System nuclear project (WNP) Nos. 1-5. He analyzed seven years of pre-operational aquatic monitoring data for WNP-2. The task involved data merging and analysis via various software packages. The process resulted in a report to state and federal agencies with a recommendation that was accepted for the design of an operational monitoring program. He designed entrainment studies for WNP-2 required by the Nuclear Regulatory Commission and the National Marine Fisheries Services. He actively participated in the preparation of a 316(a) Demonstration Document for the Hanford Generating Project. Prepared ecology, effects of thermal discharges, and effects of chemical and biocide discharge sections for the WNP-1/4 and WNP-3/5 Operating License Environmental Reports.

At Metropolitan Edison Company, Dr. Mudge managed the environmental monitoring programs performed at fossil, nuclear, and hydroelectric stations. He supervised individuals who performed the radiological, ecological, meteorological, hydrological, water, terrestrial, and air quality studies. He presented testimony before the Presidential Commission, Senate House Subcommittee on Energy and the Environment, Atomic Safety Licensing Board, and NRC on the radiological and ecological monitoring program performed near Three Mile Island Nuclear Units One and Two. Dr. Mudge is experienced with interfacing with regulatory agency representatives (NRC, EPA, PA DER, NJDEPE, NYSDEC, IDEM, WADOE). He is active in the preparation and review of environmental reports, technical specifications, preliminary and final safety analysis reports, and environmental statements.

Dr. Mudge served as a Biology instructor at the Berks Campus of the Pennsylvania State University where he instructed undergraduate studies in biology and physiology. As a graduate assistant, he taught classes in general biology, physiology, histology, cytology, and anatomy. He also taught biology to junior and senior high school studies at Arundel Junior-Senior High School.

PROFESSIONAL AFFILIATIONS

- American Association for the Advancement of Science (AAAS)
- Society for Risk Analysis
- Pennsylvania Academy of Science
- American Fisheries Society
- Ecological Society of America
- Phi Sigma-National Biological Honorary
- American Society for Testing and Materials:
  - E-47 Committee on Ecological and Risk Assessment
  - E-50 Committee on Environmental Site Assessments

PUBLICATIONS/REPORTS/PRESENTATIONS

Mudge, J.E., 1969. Gross and Microscopic Anatomy of the Brook Trout (Salvelinus fontinalis) Pancreas. M.Ed. Thesis, 34 p.

Mudge, J.E. and W.H. Neff, 1970. Microscopic Anatomy of the Brook Trout Pancreas. Proc, Penna. Acad. Sci. 44:62-65.

Mudge, J.E., 1970. Histological and DNA Cytophotometry of the Pancreas in Acid Exposed Brook Trout (Salvelinus fontinalis). M.S. Thesis, 48 p.

Mudge, J.E. and W.H. Neff, 1971. Sodium and Potassium Levels in Serum of Acid Exposed Brook Trout (Salvelinus fontinalis). Proc. Penna. Acad. Sci. 45: 101-103.

Mudge, J.E., 1972. Influence of Low pH on Electrolytes and Interrenal Histochemistry in Brook Trout (Salvelinus fontinalis). Ph.D. Thesis, 79 p.

Mudge, J.E. and R.W. Firth, Jr., 1975. Evaluation of Cooling Tower Ecological Effects - An Approach and Case History. Trans. Amer. Nuc. Soc. 21.

Mudge, J.E., A.D. Taylor, and E.C. Fuhrer. Three Mile Island Nuclear Station NPDES Permit. Pennsylvania Electric Association Meeting, May 8, 1975.

Noedder, M.F.D., J.E. Mudge, W.H. Neff, and A. Anthony, 1976. Cytophotometric Analysis of R.N.A. Changes in Prolactin and Stannius Corpuscle Cells of Acid Stressed Brook Trout. Gen. Comp. Endocrinol. 30:273-284.

Mudge, J.E., A.D. Taylor, and W.A. Potter. Fish Impingement at the Closed Cycle Cooling Water Intake of Three Mile Island Nuclear Station. Edison Electric Institute Biologists Meeting, May 18-20, 1976.

Dively, J.L., J.E. Mudge, W.H. Neff, and A. Anthony, 1977. Blood pO2 and pH Changes in Brook Trout (Salvelinus fontinalis) Exposed to Sublethal Levels of Acidity. Journal Comp. Biochem. Physiol. 57A:347-351.

Mudge, J.E., J.L. Dively, W.H. Neff, and A. Anthony, 1977. Interrenal Histochemistry of Acid Exposed Brook Trout (Salvelinus fontinalis). General Comp. Endocrinol. 31:208-215.

Mudge, J.E., 1979. Effect of Hanford Generating Project Thermal Discharges on White Sturgeon. Washington Public Power Supply System, 16 p.

Mudge, J.E., 1980. Copper Toxicity to Fish. Washington Public Power Supply System, 24 p.

Mudge, J.E., 1980. Effects of Chemical and Biocide Discharges. 15 p. in Section 5.3 of Washington Public Power Supply System Nuclear Project Nos. 1 and 4. Environmental Report.

Mudge, J.E., 1982. Effects of Chemical and Biocide Discharges. 15 p. in Section 5.3 of Washington Public Power Supply System Nuclear Project Nos. 3 and 5. Environmental Report.

Mudge, J.E., G.S. Jeane and W. Davis, 1980. Technical Review of the Ecological Monitoring Program of WNP-3/5. Washington Public Power Supply System, 147 p.

Mudge, J.E., G.S. Jeane, K.P. Campbell, B.R. Eddy, and L.E. Foster, 1981. Evaluation of a Perforated Pipe Intake Structure for Fish Protection. 27 p. in Workshop on Advanced Intake Technology, U.S. Fish and Wildlife Service Publication.

Mudge, J.E., W.S. Davis, and L.S. Schleder, 1981. Technical Review of the WNP-3/5 Ecological Monitoring Program, 79 p.

Mudge, J.E., W.A. Kiel, and L.S. Schleder, 1981. Dissolved Oxygen and Total Dissolved Gas in the Columbia River Near the Hanford Generating Project Discharge, 14 p.

Schleder, L.S. and J.E. Mudge, 1982. Pre-Operational Animal Studies Near WNP-1, 2, and 4, 1981, 24 p.

Mudge, J.E., T.B. Stables, and W. Davis, 1982. Technical Review of the Aquatic Monitoring Program of WNP-2, 146 p.

Mudge, J.E., W. Davis, T.E. Northstrom, and G.S. Jeane, 1983. Toxicity of Copper, Zinc, and their Chemical Forms to Coho Salmon and Steelhead Trout in the Chehalis River, Washington, 21 p.

Mudge, J.E., J.K. Prince, and R.A. Chitwood, 1983. Radiological Environmental Monitoring Program Report; WNP-2. 40 p.

Mudge, J.E. (ed), 1985. Operational Ecological Monitoring Program for Nuclear Plant 2: 1985 Annual Report, 356 p.

Mudge, J.E., T.E. Northstrom and T.B. Stables, 1986. Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout. Bull Environ. Contam. Toxicol. 37:350-354.

Mudge, J.E., J.B. McLaren, R.Caryk, and C.L. Lange, 1987. Alternative Intake Technology Review for Dunkirk Steam Station. Prepared for Niagara Mohawk Power Corporation, 64 p.

Mudge, J.E., 1988. Environmental Site and Risk Assessment Report: Rubenstein Property Allegheny County, Pennsylvania, 67 p.

Krysinski, D.A. and J.E. Mudge, 1988. Former Riverfront Industrial Site Environmental and Risk Assessment Report. Allegheny County, Pennsylvania.

Mudge, J.E., 1989. Environmental Impact Section in Feasibility Study of Shipping Missile Propellants by Water or Rail Carrier, U.S. Air Force, 1975 p.

Mudge, J.E., D.A. Krysinski, G.J. Larson, F.M. Berchin, and A.C. Schultz, 1989. Environmental Assessment and Underground Storage Tank Investigations, 64th Annual Health and Safety Conference, Western Pennsylvania Safety Council.

Mudge, J.E., 1989. Site Characterization Work Plan and Results for Westinghouse Electric Corporation Facility, Bloomington, Indiana to Indiana Department of Environmental Management and U.S. EPA Region V.

Mudge, J.E., and R. Bowman, 1990. Wetland Assessments: Regulatory and Technical Issues. SE Technologies, Inc., Environmental Management Presentation.

Mudge, J.E., D.A. Krysinski and F.M. Berchin, 1990. River Avenue Environmental Site Assessment and Risk Assessment Report. Urban Redevelopment Authority of Pittsburgh, PA.

Mudge, J.E., 1991. Due Diligence Environmental Assessments. National Association of Industrial and Office Parks Newsletter.

Mudge, J.E. 1991. A Review of Water Quality Based Effluent Limitations for Copper and Temperature. Prepared for PENRECO, 236 p.

Mudge, J.E. and M.D. Antonetti, 1992. Technical Review of Site Characterization and Chromium Contamination Assessment Report for Metal Foundry Operation. Charlotte, North Carolina in preparation of expert witness testimony.

Mudge, J.E. 1992. Evaluation of metals and PAH levels in Delaware River sediments prior to disposal. Public Service Electric & Gas Company. Newark, NJ.

Mudge, J.E., T.E. Northstrom, G.S. Jeane, W. Davis and J.L. Hickam. 1993. Effect of Varying Environmental Conditions on the Toxicity of Copper to Salmon. Environmental Toxicology and Risk Assessment: 2nd Volume, STP 1216, Joseph W. Gorsuch, F. James Dwyer, Christopher G. Ingersoll, and Thomas W. LaPoint, Eds., American Society for Testing Materials, Philadelphia.

Mudge, J.E. and D.A. Krysinski, 1993. Baseline Risk Assessment: Human Health and Ecological Investigation, Chillicothe, Ohio.

Mudge, J.E., 1993. Evaluation of Risk Associated with Contamination at Struthers Thomas-Flood Corporation Property. Cowley County, Kansas. Expert Witness Testimony Prepared.

Mudge,J.E., C.G. Phillips and M.J. Meyers 1994. Benthic Macroinvertebrate and Fisheries Survey Reports. Economy Borough and Legionville Hollow, Beaver County, Pennsylvania Sites.

Mudge, J.E., C.G. Phillips and J.C. Woodcock, 1994. OU2 Focused RI Report, Evaluation of Wetland Contaminants, Osborne Landfill Site. Grove City, Pennsylvania.

RESUME

KENNETH R. MILLER, P.E.

EDUCATION

M.S., Civil Engineering, University of Pittsburgh, 1981
B.S., Civil Engineering, University of Pittsburgh, 1977

PROFESSIONAL REGISTRATION

Registered Professional Engineer, Pennsylvania and Ohio

EXPERIENCE

Mr. Miller is a Vice President of Civil & Environmental Consultants, Inc. (CEC), with more than 18 years experience providing a wide range of environmental, civil, and geotechnical engineering services. Mr. Miller has extensive experience providing these services for the characterization, investigation, evaluation of alternative remedial methods, and design of corrective actions for hazardous, industrial, and coal waste sites. In addition to addressing operating or abandoned waste disposal facilities, Mr. Miller also has experience in the design and permitting of new disposal facilities, and has performed environmental assessments of numerous industrial, manufacturing, and disposal facilities. Mr. Miller has performed environmental consulting, including environmental assessment, litigation support, remedy negotiations with agencies, and cost allocation between responsible parties. Mr. Miller has also performed numerous geotechnical engineering related projects, including the design of foundations and retaining structures, stabilization of landslides, control of groundwater, and the prevention or correction of mine subsidence problems. Mr. Miller's civil engineering background includes numerous projects involving the analysis of drainage conditions and the design of hydraulic structures.

<u>Expert Witness Support</u>

Mr. Miller directed the performance of expert witness support in defense of a contractor whose activities led to a PCB release at a former steel manufacturing facility. Approximately 700 gallons of PCB oil was released from a transformer that was damaged during scrap operations. An expert report was prepared that demonstrated that the plaintiff's response actions were not in accordance with proper response procedures, and likely resulted in increased environmental damage. The litigation was settled out of court for about one-third of the originally claimed damages.

Mr. Miller directed the preparation of an expert report for a defendant being sued for estimated remediation costs at a former chemical mixing facility. The report demonstrated that the remediation costs would be less than 10% of the plaintiff's estimate. Both technical and accounting errors were identified in the plaintiff's cost estimate.

Mr. Miller directed the preparation of an expert report for litigation involving historic petroleum sludge disposal at a regional mall. The company that purchased the property sued the developer on the grounds that further development was not possible, and refinancing could not be obtained, because the site had previously been used for disposal. The analysis performed demonstrated that materials were not a hazardous waste and that there was no need for identification of the material on the property deed. Records of recent development on adjoining parcels that also contained the sludge were identified to demonstrate that refinancing for further development could be obtained. The case was subsequently settled out of court.

Mr. Miller directed the preparation of an expert report regarding potential contamination at a property subjected to litigation in bankruptcy court. Records of previous land use and previous experience on similar properties indicated that the potential existed for significant environmental liabilities on the property.

Mr. Miller directed the preparation of a report and provided sworn testimony at a zoning hearing regarding petroleum contamination of groundwater underlying a property in Pittsburgh. The testimony demonstrated that the contamination was coming from an offsite source. Also, the testimony was provided to demonstrate that regulatory agency requirements associated with the presence of contamination were precluding further development of the property. The testimony allowed the owner to obtain approval for alternative land use from the zoning board.

Environmental Engineering and Waste Management

Directed the remedial design for the Osborne Landfill Superfund site. Initially, he worked to change the selected remedy resulting in cost savings of more than $10 million to the client. The remedial design included a slurry wall containment system installed through a mined-out coal seam, a leachate extraction and treatment system, and cap. Other site remediation costs were reduced by modifications to ROD specified remedies.

Directed the assessment of cost allocation estimates for a Superfund site in New York. The assessment included separation of normal operation costs for the landfill from remedial action costs.

Managed the remedial activities for the Cleve Reber Superfund site in Louisiana from remedial investigation and feasibility study through remedial design. The project required the development and implementation of three phases of investigation and analysis to characterize the site and evaluate site risks with respect to changing regulatory criteria. A feasibility study was performed following the investigation programs that analyzed alternative methods of site remediation, including several waste treatment and destruction technologies. Following selection of the preferred method of remediation, Mr. Miller directed the design of the civil and geotechnical aspects of the remedial action, which included the draining, offsite discharge without treatment, and backfilling of a 20 million gallon pond without disturbing contaminated bottom sediments; a system to preload and dewater a municipal waste pit prior to capping; a multilayer cap to cover a 20 acre site; and site facilities including process and support areas and stormwater control facilities. Construction drawings and specifications meeting U. S. Army COE requirements were prepared as part of the design.

Assisted with the evaluation of cost claims for more than 20 sites for a major metals manufacturer. The evaluation included considerations of likely remediation action costs and a reasonable level of contribution based on site involvement. The sites included Superfund and non-Superfund sites, and sites where remedial actions were pending.

Directed the collection of data to identify potential responsible parties for an abandoned waste disposal facility in western Pennsylvania. In addition to party identification, an allocation for the parties was developed based on the types of wastes disposed and their volumes.

Directed investigation and design services for five inactive industrial sites for a client nationwide. Included were studies to characterize site contamination, followed by development of plans to remediate the sites.

Managed or conducted numerous environmental assessments at industrial, manufacturing, disposal, and 1proposed developments. These assessments have included the evaluation of more than 60 solid waste management units (SWMUs) at a large steel manufacturing facility in the west to estimate the potential environmental liabilities at the facility prior to its transfer to new ownership. At another steel manufacturing facility, Mr. Miller managed the assessment of the impact of pickle liquor disposal in an abandoned sandstone quarry. Other assessments have been performed for metal fabrication and machining operations, and the sites of proposed mall, hospital, housing and retail developments.

Directed all public sector hazardous waste projects for ICF Technology's Pittsburgh, Pennsylvania office from 1987 until joining CEC. In this capacity, Mr. Miller was responsible for directing projects of a value of more than $5 million annually that primarily involved the performance of remedial investigations, feasibility studies, remedial design, and remedial action implementation. Mr. Miller was responsible for the technical review and quality control on all projects, as well as schedule and budget performance. This work included the performance of up to 15 projects simultaneously in states ranging from Massachusetts to Texas. The work directed by Mr. Miller consistently received high evaluation from the sponsoring agencies. While directing this work, Mr. Miller continued to manage individual projects.

Managed a Remedial Investigation (RI) for the Republic Steel Quarry Superfund site that resulted in the deletion of the site from the National Priority List. Mr. Miller's initial assessment of data collected by both the EPA and a consultant for the site owner indicated that serious technical errors by both groups probably resulted in an overestimation of site risks. The RI developed by Mr. Miller confirmed that site risks were previously overestimated and that the site could be deleted without the performance of extensive remedial action.

Managed the remedial investigation and feasibility study for the PJP Landfill Superfund site. The project was complicated by its location beneath a major bridge leading into New York City. The project included extensive geophysical investigations, followed by the excavation of test pits to locate and sample buried drums. The project required constant coordination with state and local government agencies due to its location beneath the bridge and adjacent to industrial and residential areas.

Managed the preparation of construction specifications and drawings for the closure of an abandoned industrial hazardous waste site in western Pennsylvania. The plans required that the wastes be placed in a secure disposal site which would encapsulate the waste and allow monitoring for contaminant migration. Mr. Miller also managed the field services during the construction, which included quality control testing, construction documentation, and health and safety training and monitoring for contractor personnel.

Managed the development of a closure design for an abandoned industrial waste hollow fill disposal site. The closure design involved the regrading of the waste slopes to improve stability and the control of surface water on and adjacent to the waste pile. Construction drawings and specifications were developed for the design after approval by the state regulatory agency.

Lead technical reviewer for numerous remedial investigations and feasibility studies, including the Summit National, Norwood PCB, Old Springfield Landfill, Dorney Road Landfill, Tri-State Plating, and Fultz Landfill Superfund sites. For these projects, Mr. Miller assembled teams of reviewers based on the technical requirements of the projects, evaluated comments and assisted with document revisions, and provided technical review.

Co-developed a training program to assist regulatory personnel with the management of remedial design projects. The program focused on examples of actual projects and the types of problems that will occur during design so realistic schedules and budgets are established.

Managed the preparation of the Remedial Action Master Plan (RAMP) for the Presque Isle site in Erie, Pennsylvania. This project involved the collection, review, and evaluation of all available site data to identify objectives for the proposed remedial investigation. The final RAMP included a work plan outline for the site remedial investigation and feasibility study.

Utility Projects

Managed the design of a new ash disposal site for an electric utility in Marion County, West Virginia. Investigations were performed to determine design parameters for both the ashes to be disposed, and the natural soil and rock materials in the disposal hollow. The plans included the preparation of designs for the construction of sediment ponds with adjustable outlets to control discharge water quality, the design of a subsurface drainage system to collect leachate and outlet it to the ponds, surface water facilities to control water on and adjacent to the pile, and a haul road system to provide access to the disposal pile and related facilities.

Managed the investigation and design of remedial actions to stabilize a 200 acre-foot ash lagoon in Berkeley County, West Virginia. The project included the drilling of borings to obtain embankment soil strength data, the installation of wells to estimate water levels within the embankment, and the performance of analyses to estimate the embankment stability. A system was designed using a synthetic liner on the inside embankment slope and buried in a cutoff trench to reduce the water level within the embankment and cutoff seepage at the downstream embankment toe.

Developed short-term and long-term ash water control plans for an ash disposal site in Ohio that outletted into a city sewer system. The sewer was periodically blocked by ash and the city had threatened legal action against the utility. A plan was prepared that utilized an existing road embankment to provide temporary control while long-term plans were prepared. The long-term plans diverted water away from the sewer system along a power line right-of-way for discharge to an open channel storm drain.

Managed the design of a correction to a landslide associated with an FGD sludge tram that transported sludge from the generating plant to the disposal area. Additionally, the access road system to tram towers needed modified to allow better access to the towers and to prevent road drainage from discharging into the slide area. Plans and specifications were developed for road and landslide repairs, and Mr. Miller provided consultation and managed inspection services during construction.

Managed the development of a four-phase extension plan for an existing ash disposal area. The plans developed included the use of existing concrete drainage facilities to reduce new construction costs and utilization of disposal areas limited by property restrictions and utility clearances.

Managed the performance of field and laboratory testing of stabilized ash to evaluate its usefulness as a construction material and potential alternative disposal methods. Samples of the ash were obtained as it entered the disposal area. The ash was tested for in-place density, and a series of samples were prepared in the field for further laboratory testing. Laboratory testing indicated the evaluation of the variability of the strength of the ash with various curing times and methods.

Civil and Geotechnical Engineering

Managed SRW's soils testing laboratory. Managed the development of a computer program to inventory and track laboratory samples and reduce all laboratory tests performed in the laboratory. Also managed the upgrading of laboratory equipment and procedures to obtain Corps of Engineers' certification.

Managed over 100 projects for the analysis and design of foundation systems to support proposed or existing structures. These projects involved the investigation of subsurface conditions, analysis of various foundation types placed on the subsurface materials, and the development of recommended foundation types based on structure tolerances and performance criteria.

Managed numerous projects involving the analysis and control of landslides. These projects involved investigations of the causes of the landslides and the analysis of various methods for controlling or preventing further movements. The studies involved the consideration of several alternatives for slope stabilization, with a final recommendation based on the effectiveness and costs of the various alternatives.

Managed numerous projects involving the analysis of surface water drainage conditions and the design of hydraulic structures to convey flows. The conditions of the contributing watersheds were assessed, along with the size and configurations of any existing hydraulic structures. Flows were estimated and designs were developed utilizing computer analysis techniques.

Mining Related Projects

Managed the design of a three coal refuse disposal system for a new mine complex in western Pennsylvania. The system included one water and slurry impounding disposal area and two non-impounding disposal areas. Design considerations included the presence of mined-out coal seams at shallow depths below the proposed disposal area locations and development restrictions due to property acquisition problems and other mine facilities.

Developed plans for the closure of an operating coal slurry impoundment in southwest Virginia. This impoundment was located at the downstream end of a large watershed which required the design of large spillway and diversion facilities to control the design storm during the closure process. Additionally, complex stability analyses were performed to demonstrate the integrity of the embankment as coarse refuse was placed over coal slurry.

Prepared designs and permit documents for the construction of more than 20 coal refuse disposal areas. These projects involved the collection of geotechnical and environmental data, analysis of embankment stability, design of erosion and sediment control facilities, preparation of construction drawings and specifications, and completion of permit documents.

Managed the development of reclamation plans for a burning, unstable, abandoned coal refuse pile in Boone County, West Virginia. Designs were developed to prevent the pile from sliding, which would block an active mine opening, and to prevent the pile from further degrading the water quality of the protected trout system at the toe of the disposal area. A buttressing system was designed, along with surface water controls.

Managed the permitting of 24 mine facilities for a single client with simultaneous permit deadlines. The permit applications included the design of surface water and sediment control facilities, preparation of design and permit drawings, and permit application preparation. Additionally, environmental data was collected and summarized for permits, including surface water and groundwater analysis results.

Managed the design of correction of a landslide along an abandoned strip mine bench that threatened an operating automobile dealership. The design included a retaining wall to hold back the landslide and provide an area for car storage, and deep mine seals with provisions for drainage collection and conveyance away from the landslide area.

Managed the investigation and design of a method to stabilize a large home that was being pulled apart by tension from mine subsidence. A system of rock anchors and thrust walls were designed to push the house together and prevent further damage.

Managed a design to move a home that was being damaged by mine drainage into the basements. A shallow foundation system was designed to avoid future water problems, while a utility shed was added to the home to replace basement storage.

Designed a system to collect mine drainage that was damaging several homes and to correct damage to one home along a hillside in Martins Ferry, Ohio. A slurry wall installed to cutoff drainage to the surface resulted in high seepage pressures against foundation walls and damaged the homes. The system designed by Mr. Miller relieved the high seepage pressures and eliminated water from the basements of the homes.

Managed the design and permitting of more than 10 coal preparation facilities. These permits included the collection of environmental data, design of stormwater and sediment control facilities, and preparation of permit forms and narratives.

Performed a geotechnical investigation and developed preliminary foundation and site preparation recommendations for a two mine/plant facility. Also developed drainage and sediment control plans for the facility.

Performed geotechnical investigations and provided recommendations for foundations for mining related structures, including stacking tubes, coal silos, conveyors, trams, thickeners, and other preparation plant structures.

Designed a retaining wall to stabilize a landslide and utilize the entire coal storage area associated with a stacking tube and reclaim tunnel. Approximately 300 feet of slope was stabilized.

PROFESSIONAL AFFILIATIONS

American Society of Civil Engineers
American Society for Testing Materials

PUBLICATIONS

"Fast Tracked Hydrogeologic Study - Cleve Reber Superfund Site," Proceedings of the 5th National Conference on Management of Uncontrolled Hazardous Waste Sites, November 1985, Washington, DC (with B. Laswell and J. Hullinger).

"Engineering and Design Manual for Disposal of Excess Spoil," prepared by CTL/Thompson Inc. for the Office of Surface Mining, U.S. Department of the Interior, Contributing Author.